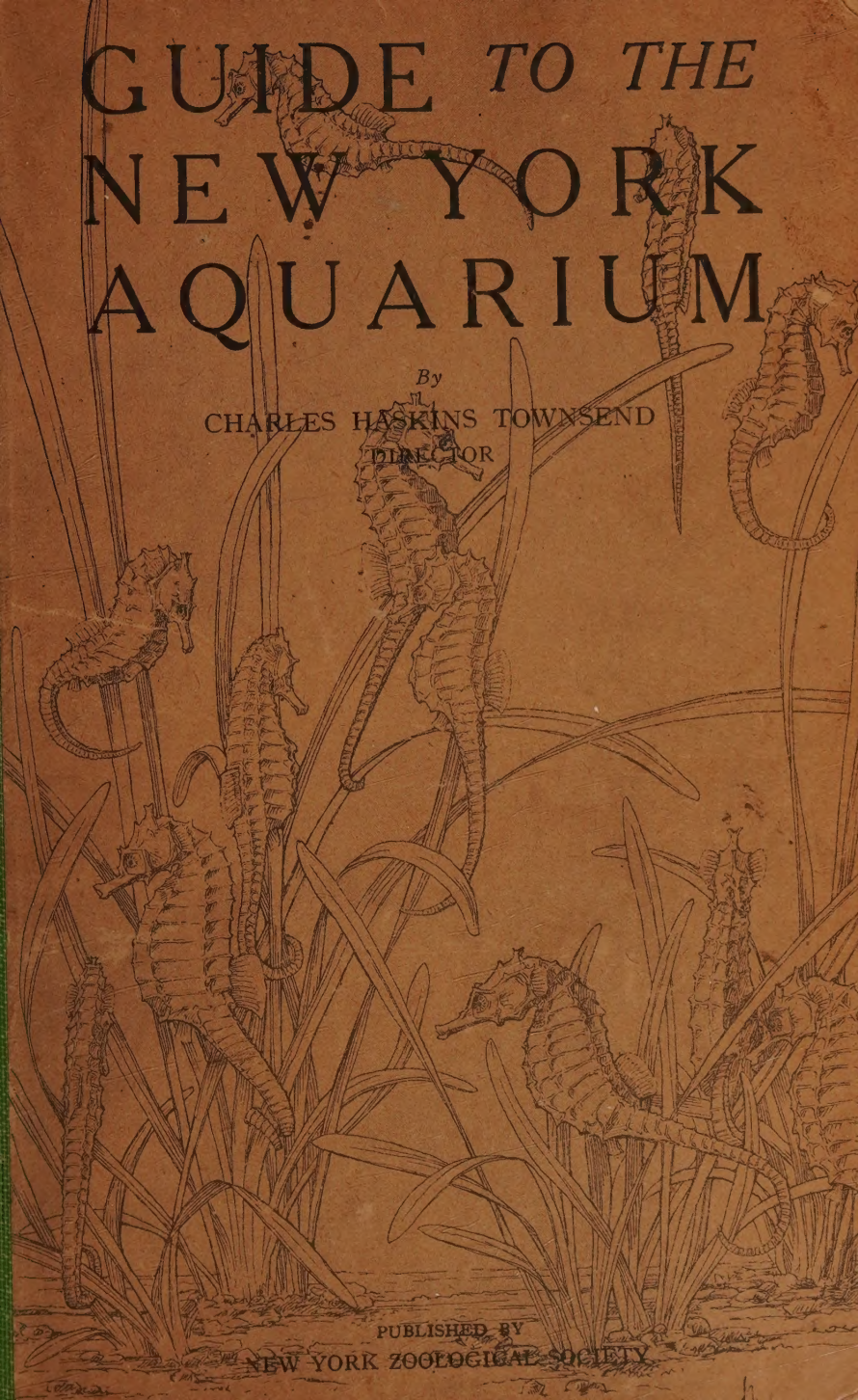
GUIDE TO THE NEW YORK AQUARIUM

By
CHARLES HASKINS TOWNSEND
DIRECTOR



PUBLISHED BY
NEW YORK ZOOLOGICAL SOCIETY

Guide

TO THE

New York Aquarium

BY

CHARLES HASKINS TOWNSEND

Director

Illustrated from photographs of living specimens made in the Aquarium by E. R. Sanborn, F. W. Hunt, and others

---

PUBLISHED BY THE

NEW YORK ZOOLOGICAL SOCIETY

101 PARK AVENUE, NEW YORK

1925

First Edition, 1919—16,000
Second Edition, 1925—20,000

Copyright, 1919, 1925
New York Zoological Society

INTELLIGENCER PRINTING COMPANY
LANCASTER, PA.

CONTENTS

Page

The Aquarium, management, methods, etc. 9

The Collections 12

Vertebrates:

- Fresh-Water Fishes 16
- Marine Fishes 41
- Turtles 102
- Crocodiles and Alligators 113
- Aquatic Serpents 114
- Frogs 114
- Salamanders 116
- Seals and Sea Lions 121
- Manatees 124
- Porpoises and Whales 127
- Beavers 128

Invertebrates:

- Crabs and Lobsters 129
- Starfishes and Sea Urchins 137
- Jellyfishes, Anemones and Corals 138
- Shellfish 142
- Mosquito Hatching Exhibit 145

Balanced Aquaria 146

Fishes for Small Aquaria 147

The Care of Small Aquatic Animals:

- Small Fresh-Water Aquaria 152
- Turtles and Small Alligators 156
- Small Salt Water Aquaria 158
- Salamanders and Frogs 162

ILLUSTRATIONS

	PAGE
AQUARIUM BUILDING	
Interior	Frontispiece
Service Gallery	10
Exterior	8
FRESH-WATER FISHES	36
Black Bass	
Blue Catfish	20
Blue-nosed Sunfish	34
Bony Gar	18
Bowfin	19
Brown Trout	28
Bullhead	20
Burbot	41
Butterfly	149
Catfishes	20
Chain Pickerel	31
Channel Catfish	20
Chub Sucker	22
Climbing Perch	147
Crappie	37
Dog Fish	19
European Rudd	26
Fresh-water Drum	40
Fresh-water Cusk	41
Gars	18
Goggle-Eye	35
Golden Shiner	25
Goldfish	24
Grass Bass	36
Green Pike	31
Half Moon	148
Horned Pout	20
Horny Chub	22
Jack	31
Lake Bass	40
Lake Sturgeon	17
Ling	41
Long-eared Sunfish	33
Mudfish	19
Muskallunge	32
Oswego	36
Paradise Fish	150
Pearl Roach	26
Pickerel	31
Pike Perch	38
Quillback	23
Rainbow Trout	29
Red-Eye	35
Roach	25
Rock Bass	35
Rudd	26
Salmon Trout	29
Short-nosed Gar	18
Spotted Catfish	20
Sturgeon	17
Sucker	21
Sunfish	33–34
Trouts	28–29
Wall-Eyed Pike	38
White Bass	40
Whitefish	30
Yellow Perch	39
MARINE FISHES	
Angel-fishes	82–83
Angler	99
Basses	60–61
Bellows-fish	99
Bermuda Chub	73
Black Margate	70
Blackfish	78
Black Angel-fish	83
Blue Angel-fish	82
Blue-striped Grunt	68
Butterfly Fish	85
Chub	73
Codling	98
Coney	60
Crabeater	57
Cowfish	89
Crevalle	55
Cunner	79
Doctor Fish	86
Drumfish	75
Eel-Pout	95
Fishing Frog	99
Four-Eyes	84
French Angel-fish	83
Goose-fish	99
Grass Porgy	72
Gray Snapper	66
Groupers	42–58–62–63
Grunts	68–69
Happy Family of Fishes	100
Hogfish	77
Horse-Head	54
Jewfish	42
Leather Jacket	87
Long-Spined Sculpin	92
Look Down	54
Margate	70
Minnow	50
Moonfish	54
Morays	46
Mullet	52
Mutton Fish	9[illegible]
Muttonfish	66
Nassau Grouper	62
Ocean Sunfish	91
Parrots	80–81
Perch	62
Pinfish	71
Porgy	72
Porkfish	71
Prickly Skate	43
Pudding Wife	79
Puffer	90
Queen Triggerfish	88
Rabirubia	64
Radiograph of Butterfly Fish	85
Rainbow Parrot-fish	80
Red Grouper	63
Red Parrot-fish	81
Red Snapper	65
Red-winged Sea Robin	96
Rockfish	61
Runner	56
Sailor's Choice	71
Sand Shark	42
Sandfish	94
Scamp	59
Schoolmaster	68
Sculpin	92
Sea Bass	60
Sea Horse	51
Sea Raven	93
Sea Robin	96
Sergeant Major	76
Shark Sucker	97
Sheepshead	74
Sheepshead Minnow	50

ILLUSTRATIONS

PAGE

Skate 43
Snappers 65–66–67
Spadefish 82
Spot Snapper 67
Spotted Codling 98
Squirrel-fish 53
Sticklebacks 50
Striped Bass 61
Sturgeons 45
Sunfish 91
Tautog 78
Ten-Pounder 48
Tiger Rockfish 63
Toadfish 94
Tom Tate 70
Trigger-fish 88
Trunk-fish 88
Yellow-fin Grouper 58
Yellow Grunt 69
Yellowtail 64
White Perch 62

TURTLES

Atlantic Green Turtle 111
Blanding's Turtle 104
Box Tortoise 106
Diamond-back Terrapin 107
Giant Snapping Turtle 101
Hawksbill or Tortoise-shell Turtle 110
Leatherback Turtle 111
Matamata Turtle 109
Muhlenberg's Turtle 108
Snapping Turtles 101–103
Soft-Shelled Turtle 104
Spotted Turtle 108
Wood Turtle 105

ALLIGATORS AND CROCODILES

Alligator 112
Crocodile 113

FROGS

Bull Frog 114
Leopard Frog 115

PAGE

SALAMANDERS

Axolotl or Spotted Salamander 119
Blind Salamander 118
Hellbender 116
Mud Puppy 117
Newts 120
Siren or Mud Eel 119

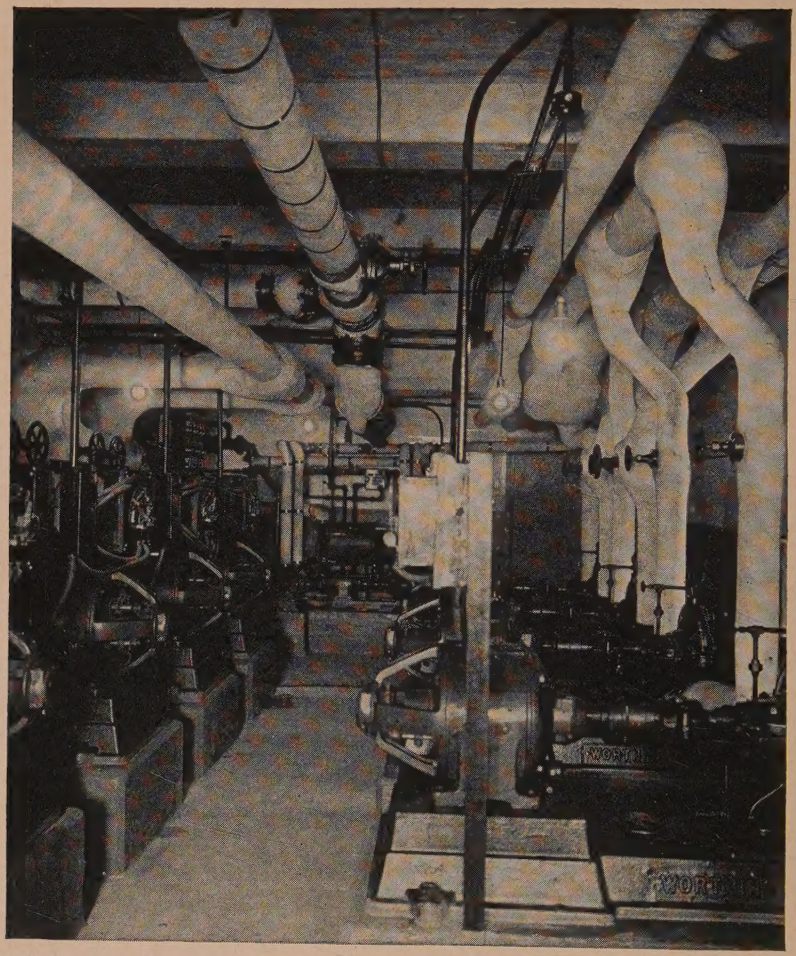
MAMMALS—Seals, Sea Lions, Manatees and Porpoises

Dolphin 128
Elephant Seal 124
Fur Seal 122
Harbor Seal 123
Manatee 125–126
Porpoises 125–127
Sea Lion 121
West Indian Seal 122

INVERTEBRATES—Crabs, Lobsters, Jellyfishes, Anemones, Corals, Shellfish, Mosquito larvae

Anemones 140–146
Blue Crab 133
Channelled Whelk 142
Coral 140
Crayfish 136
Horseshoe Crab 129
Jellyfish 139
Lobster 135
Locust Lobster 134
Mantis Shrimp 131
Mosquito Larvae 145
Octopus 141–143
Portugese Man-of-War 139
Sea Soldier 132
Shipworm 144
Spider Crab 130
Spiny Lobster 134
Starfish 137
Tubularia 140
Whelk 142

BALANCED AQUARIA 146–152



ELECTRIC PUMPING EQUIPMENT IN THE NEW YORK AQUARIUM

New York Zoological Society

President
MADISON GRANT

First Vice-President
FRANK K. STURGIS

Second Vice-President
HENRY D. WHITON

CORNELIUS R. AGNEW, *Treasurer*, 22 William Street
WILLIAM WHITE NILES, *Acting Secretary*, 27 Pine Street
FARMER'S LOAN & TRUST COMPANY, *Assistant Treasurer*

EXECUTIVE COMMITTEE

MADISON GRANT, *Chairman*

WILLIAM WHITE NILES
FRANK K. STURGIS
HENRY D. WHITON
HENRY FAIRFIELD OSBORN, JR.
PERCY R. PYNE
ANTHONY R. KUSER
HARRISON WILLIAMS
GEORGE D. PRATT

CORNELIUS R. AGNEW, *Ex-Officio.*

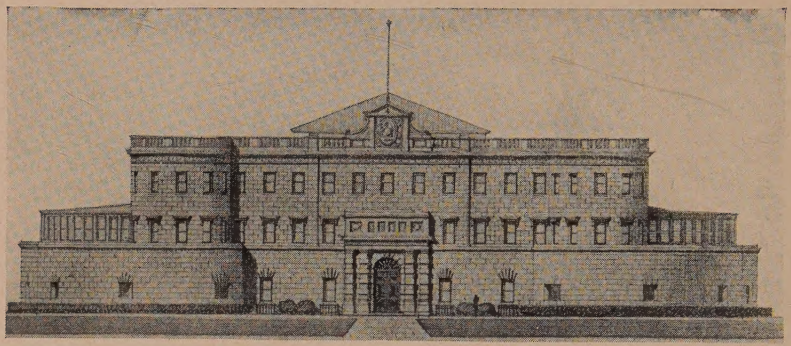
GENERAL OFFICERS

WILLIAM T. HORNADAY, *Director*, Zoological Park
CHARLES HASKINS TOWNSEND, *Director*, New York Aquarium

GEORGE S. HUNTINGTON, *Prosector*
H. C. RAVEN, *Associate Prosector*
H. DE B. PARSONS, *Consulting Engineer*
R. L. CERERO, *Bursar*

OFFICERS OF THE AQUARIUM

CHARLES HASKINS TOWNSEND, *Director*
LOUIS L. MOWBRAY, *Chief Aquarist*
CHARLES M. BREDER, JR., *Aquarist*
IDA M. MELLEN, *Aquarist and Secretary*
JAMES C. MOORE, *Chief Engineer*
MARVIN C. FENSTEMAKER, *Clerk.*



THE NEW YORK AQUARIUM
Showing new third story at front of building
(Reproduced from the architect's drawing)

THE WELL-BOAT SEAHORSE

A power and sail vessel 35 feet long, used in collecting fishes for the Aquarium. It has a water compartment for carrying fishes alive, a variety of nets and berths for four men.

THE AQUARIUM

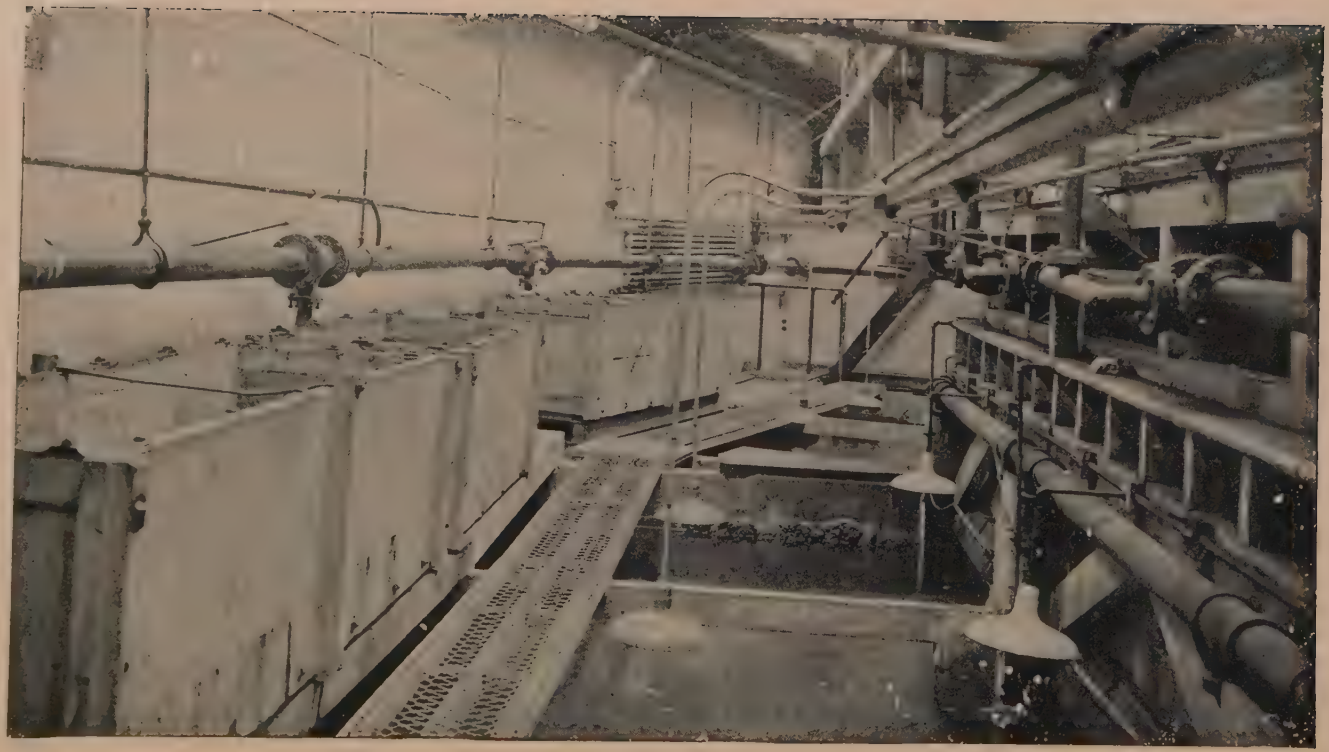
Equipment and Methods

The Aquarium is situated in Battery Park at the foot of Broadway and is reached by all elevated, surface and subway lines running to South Ferry. The nearest elevated station is Battery Place; the nearest subway station Bowling Green.

The building is open free, every day in the year. It is closed on Monday forenoons, except to school teachers with their classes, and to members of the New York Zoological Society. When a holiday occurs on Monday the public is admitted as on other days. The hours for visitors are: 9 a. m. to 5 p. m., April-September; 10 a. m. to 4 p. m., October-March.

The New York Aquarium is probably the largest of all aquariums, containing a greater number of species and of specimens than any other institution of its kind. It has seven large floor pools, ninety-four large wall tanks and thirty smaller tanks. There are also twenty-six large reserve tanks containing specimens not on exhibition. The building is circular in form, with a diameter of two hundred and five feet. The largest pool is thirty-seven feet in diameter and seven feet deep.

The Aquarium is equipped for heating sea water for tropical fishes in winter and has a refrigerating plant for cooling fresh water in summer. An air compressor furnishes aeration to all tanks when necessary. Flowing fresh water is supplied from the city water system, while the pumps circulate about 300,000 gallons of salt water daily. The pumps run continuously. Brackish water for the large floor pools is pumped from the bay through a well under the building, being filtered before it is used. The salt-water wall-tanks are supplied from a reservoir adjacent to the building, holding 100,000 gallons of pure, stored sea water. This water, originally brought from the sea by a tank steamer, is used as a "closed circulation," and has been used without change, except for small additions, since 1907. The water is pumped through the exhibition tanks, falling



VIEW IN THE SERVICE GALLERY

Showing the recently enlarged exhibition tanks with wooden reserve tanks mounted at left. Not open to the public.

thence through sand filters, back to the reservoir. The supply pipes to all tanks are vulcanized rubber. The drainage pipes from the salt-water tanks to the reservoir are iron pipes, lead lined.

The fish hatchery, maintained chiefly as a fish-cultural exhibit, produces yearly several millions of young food and game fishes, which are afterwards deposited in New York State waters. Fish eggs for its operation are supplied from the hatcheries of the United States Bureau of Fisheries.

There is a laboratory containing many kinds of small marine invertebrates which is visited by about 5,000 school children with their teachers during the year. The laboratory is used at times by specialists in the high schools and universities of the City for marine biological investigations, and contains equipment for such work.

The library attached to the Director's office consists of about 1,000 volumes, and is confined to works relating to fishes, fish-culture, fishery industries, angling and aquatic life in general. The collection of pamphlets on similar subjects is a large and valuable one.

The Aquarium published annual reports, occasional bulletins, and the *New York Aquarium Nature Series*, consisting of books and pamphlets on aquatic life. All of these are issued as publications of the New York Zoological Society.

The Aquarium was established by the City on December 10, 1896, and on November 1, 1902 its management was transferred to the New York Zoological Society under the Department of Parks of the City of New York. The Society is a scientific association with a subscription membership in 1925 of 2,725. The Director of the Aquarium and other officers appointed by the Society direct the institution and its employes, and are responsible for the public convenience and welfare, and for the work in the schools. The annual maintenance fund of the Aquarium, minimum $45,000, is provided by the City, all its exhibits being supplied by the Society.

The attendance has always been remarkably large, amounting, for the twenty-eight years ending December 31, 1924, to over fifty-four millions of visitors, or more than five thousand a day.

The Aquarium building was erected in 1807 by the United States Government as a fort, called West Battery, and after the War of 1812 was called Castle Clinton. In 1823 the building was ceded by Congress to the City of New York and used as a place of amusement called Castle Garden. It was connected with Battery Park by a bridge, the intervening space having since been filled in. General Lafayette was received here in 1824; Louis Kossuth in 1851; Professor Morse demonstrated here in 1835 the use of the Morse telegraphic code and Jenny Lind began singing here in 1850. The building was used as a landing place for immigrants from 1855 to 1890, during which period 7,690,606 immigrants passed through its doors.

THE COLLECTIONS

It is not the purpose in this guide to the collections of the New York Aquarium to refer to all of the many forms of aquatic life that have been exhibited since its inception, but rather to those which most frequently may be seen here. The space for living exhibits being limited to about one hundred tanks and pools, the visitor cannot expect to find at any one time more than a fair proportion of the species herein described.

The exhibits change to some extent in character with the mere change of seasons. Migratory fishes that are to be found along our shores in summer may not only disappear in winter, but fail to survive the change of temperature when retained in the tanks of the Aquarium. On the other hand, northern species appearing in late autumn and captured for winter exhibition, may not survive the higher water temperature of the following summer.

While the Aquarium is equipped with both heating and cooling systems for its water supply, it is not prepared to provide ideal conditions for *all* forms of aquatic life throughout the year. Such arrangements could be made, but they would necessitate extensions in the mechanical department at the expense of space devoted to exhibits.

It sometimes happens that species of moderate interest are sacrificed to make room for new arrivals of special interest. Experience has shown also the desirability of retaining as per-

manent exhibits many hardy species well adapted to the conditions of captivity, rather than others of delicate organization requiring special foods or extra care.

During the twenty-two years that the Aquarium has been open to the public more than three hundred and fifty different kinds of fishes have been exhibited. These have included one hundred and eighteen fresh-water species, one hundred and twenty-nine tropical marine species, and one hundred and eleven northern marine species.

The records of the Aquarium show that these have been the larger and more conspicuous kinds, little effort having been made to exhibit the very small fresh-water species, or the great variety of foreign fishes available for keeping in small table aquaria. This has been due to the lack of suitable space in the building for the maintenance of small aquaria which required special treatment.

The large stationary, glass-fronted exhibition tanks, of which the Aquarium has ninety-four, have therefore been stocked with showy tropical fishes and the food and game species which seem to be of the greatest interest to visitors. It has, moreover, been necessary to reserve space for some of the more conspicuous or important invertebrates.

By arranging suitable combinations, it has usually been possible to exhibit about two hundred different kinds of fishes at one time. While ideal conditions have been lacking, and many desirable forms omitted, the number and variety of fishes regularly exhibited is still much greater than in any other aquarium. The total number of specimens of fishes kept in the Aquarium, exclusive of young fry in the troughs of the hatchery, usually exceeds five thousand.

With the character of the exhibits varying considerably from month to month, it is not practicable to describe the inmates of the Aquarium by their groupings in the exhibition tanks which are subject to change, but rather to refer to them by species, leaving the visitor to identify them by their illustrated labels. This is a simple matter, as the marine and fresh-water species are located on opposite sides of the building. Certain fishes or other aquatic forms too large for the glass-fronted tanks, are distributed among the seven large pools located on the floor of the Aquarium. Zoological arrangement of species

in the tanks is not practicable, as it involves considerable shifting of specimens, which is harmful. Visitors on entering the building will find it advantageous to keep to the right, both on the main floor and balcony, as that is the general direction in which the crowd moves.

Strange as it may seem, the collection of showy tropical fishes in the Aquarium is more easily maintained than the fresh-water or marine fishes of local waters. This is not because they endure captivity better, but because they can be transported more cheaply and safely. Five hundred good-sized fishes can be brought by steamer from Florida or Bermuda at less cost and with less loss of specimens in transit than half that number by rail. Transportation by sea is cheap, and shipping tanks can be supplied with flowing sea water during the voyage by mechanical means.

Fishes can be transported only in their natural element and with enough of it to insure its continued purity. In shipments by rail, expressage has to be paid not on the number of fishes brought in, but on the heavy tanks of water containing them. Whether fishes are transported by sea or land, they must be "personally conducted" in order that proper aeration of the water may be maintained every hour of the day and night while in transit.

The exhibits in general are representative of the aquatic life of the adjacent northeastern states and the Atlantic coast region from New York to Florida. Collections from the western states and foreign countries are seldom acquired for reasons connected chiefly with expense.

Many of the tropical fishes in the Aquarium have the capacity for making instantaneous changes in color or markings. The color cells of the inner skin are under the nervous control of the fish, which may change color at any moment. Some species have several distinct color phases, all of which may be assumed within a few moments. The visitor can detect the changes best by observing some individual fish for a short time, rather than by permitting the eye to wander rapidly from one specimen to another.

The length of life of fishes in captivity is dependent upon many things. Years ago, when the tanks of the Aquarium holding marine fishes were filled with brackish and sewage-

laden water, pumped from the harbor, the exhibits could be maintained only by constant collecting. After a reservoir had been built and filled with pure sea water from the open ocean, the annual losses were reduced by half.

Some species are hardy and live many years in the Aquarium while others are difficult to provide for. The food of fishes in captivity is necessarily somewhat different from that which they find in nature.

For many of the southern and even tropical fishes which come to our shores in summer, we are indebted to the Gulf Stream, the mighty river of the ocean flowing northward along the Atlantic Coast. Its warm, sweeping current is a potent influence in the distribution of marine life.

It is not easy to write biographies of all our fishes. The ways of native species have been studied to some extent and many interesting facts have been recorded. Of tropical fishes we know less. The standard books inform us as to their geographic distribution, size and commercial importance, but contain little relating to their habits.

The scientific names following the common names will probably be regarded as quite unnecessary. No doubt they are to most persons, but they are necessary to classification and the student has need of them. A fish may have a different common name in each state or region in which it is found, while the language of science is universal.

The collection of frogs, salamanders and fresh-water turtles in the Aquarium has never been large, owing to the limitations of the building. These cold-blooded animals require the warmth of summer. Winter sends them all into retirement or torpidity. Most of them in captivity are benefited by being kept where sunlight can reach them, and at present this is not possible. The very large salamanders are hardy enough to endure the flowing fresh water supplied to the exhibition tanks from the City water system the year round. The keeping of alligators is not difficult as long as the temperature of the water is maintained at about eighty degrees. They do not feed freely except when actually warm.

Seals, manatees and porpoises have been kept at the Aquarium with varying degrees of success. These large lung-breathers cannot be provided with sufficient pure air in winter when

the building is heated, and as most of them require more room for exercise than is available, they are not adapted to continuous indoor life.

The collection of invertebrates is not large, owing to the lack of a cold sea-water system. Only the more conspicuous and hardy forms are therefore considered here. For a general account of the marine invertebrates of the region about New York, the visitor is referred to an illustrated work published by the Aquarium, entitled *Sea Shore Life*.

A list of publications of the New York Zoological Society relating to the collections of the Aquarium will be found on the last page of this guide.

FRESH-WATER FISHES

LAMPREYS—Petromyzonidae.

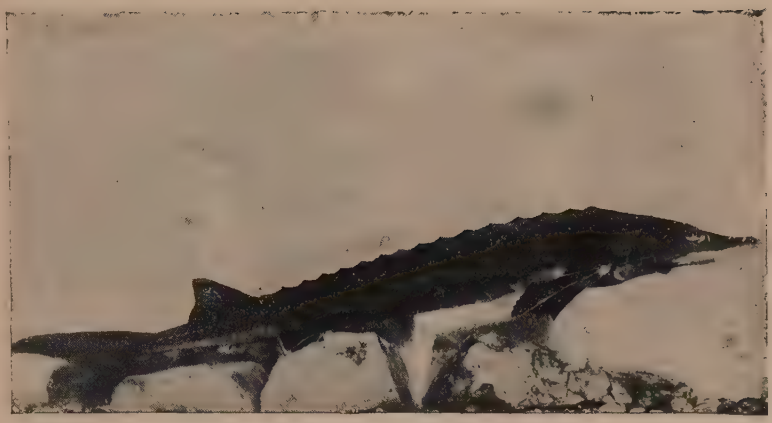
The lampreys are smooth-skinned, eel-shaped fishes, with nearly circular mouths. The majority attach themselves to fishes by suction, and feed by scraping the flesh with their rasp-like teeth. The Brook Lamprey (*Lampetra wilderi*) is usually less than eight inches in length. It is confined to fresh waters and ascends small streams at spawning time, often in great numbers, clinging by suction to rocks in climbing rapids. This species is not known to be destructive to other fishes as are the larger kinds of lampreys.

PADDLE-FISHES—Polyodontidae.

The Paddle-fish (*Polyodon spathula*) is not adapted to life in captivity, the elongated upper jaw, called the paddle, having a very sensitive tip and being subject to serious injury. It is sometimes 15 inches in length. Specimens of this fish received at the Aquarium have lived but a few days. A six-foot individual weighed 150 pounds. It is found only in the Mississippi and its tributaries. Valued for its flesh and its roe, which is made into caviar.

STURGEONS—Acipenseridae.

The Lake Sturgeon (*Acipenser rubicundus*) is our largest fresh-water fish, sometimes reaching a length of nine feet. It was formerly very abundant in the Great Lakes, and being then of little commercial importance, enormous numbers were wasted. It has now become scarce from over-fishing, and, not



LAKE STURGEON *(Acipenser rubicundus)*

being well adapted to the methods of artificial propagation, the permanence of the supply is endangered. The sturgeon is found also in waters of the upper Mississippi region, and is still common in the larger bodies of water of the far north. It is valued chiefly for its roe, which is made into expensive caviar. Its flesh, either fresh or smoked, has now a high market value.

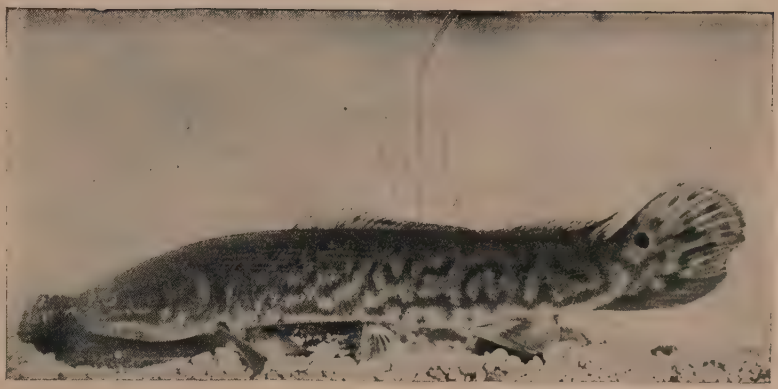
GARS—Lepisosteidae.

A fish that has lived long in the Aquarium is the Bony Gar (*Lepisosteus osseus*). There are specimens now in the tanks which have been there twenty years. It is in fact one of the winners in the struggle for existence, fossil gars of the same genus having been found in Eocene deposits both in America and Europe. The bony gar is found in most of our waters from Vermont to Mexico. It is the enemy of all other fishes, and is so voracious that serious efforts have been made toward its extermination in small lakes. Wearing an armor of hard plates, it has no enemy but the fisherman to whom it is merely a destructive nuisance.

Sharing the captivity of the Bony Gar is another species, the Short-nosed Gar (*Lepisosteus platostomus*) from western waters. It is similarly armored with heavy scales and has the same destructive habits.

BONY GAR *(Lepisosteus osseus)*

SHORT-NOSED GAR *(Lepisosteus platostomus)*



MUDFISH

The largest of the gars and in fact one of the largest American fresh-water fishes, is the Alligator Gar (*Lepisosteus tristoechus*), rivaling the sturgeon in size. Specimens twelve to fourteen feet in length have been taken. Powerful and voracious, it is the fresh-water counterpart of the shark, and inhabits the lower Mississippi and streams of the Gulf of Mexico. It is probably hardy in captivity, like other gars, but the Aquarium has not yet received specimens in sound condition. This fish is not used for food in the United States but is valued in the markets of Tampico, Mexico.

MUDFISH—Amiidae.

Closely related to fossil forms is the Bowfin (*Amia calva*), also called Mudfish and Dog Fish, the only living species of the family *Amiidae*. It is remarkably hardy, and the Aquarium has specimens that have lived in the building eighteen years. It is abundant in the Great Lakes and throughout the Ohio and Mississippi valleys. Although reaching a good size, nearly two feet in length, the bowfin has been but little utilized for food until recently. It is now being shipped to eastern markets with consignments of carp. The bowfin makes a nest on the bottom among aquatic vegetation, the male parent protecting both eggs and young.

CATFISHES—Siluridae.

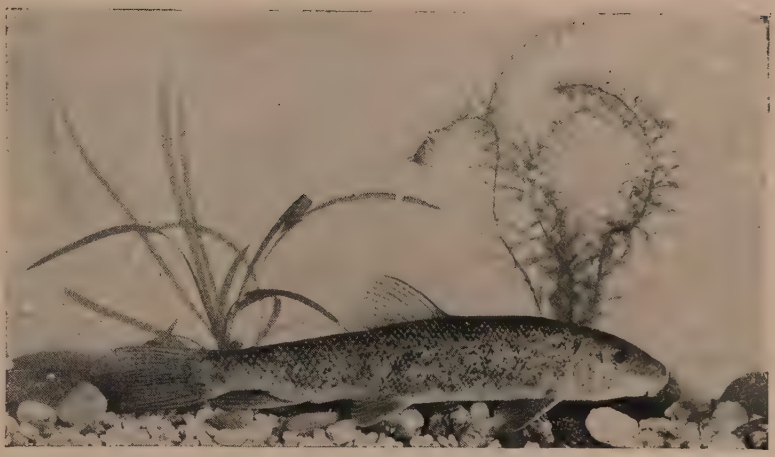
One of the best of the catfish tribe is the Spotted Catfish (*Ictalurus punctatus*), also called Channel and Blue Cat.

SPOTTED CATFISH *(Ictalurus punctatus)*

Found everywhere in the middle and eastern states except in streams tributary to the Atlantic. It grows large and contributes much to the food supply of the country. The spotted catfish is taken chiefly with hand and set lines. It inhabits more swiftly flowing waters than do other catfishes.

The Common Catfish (*Ameiurus nebulosus*), known also

HORNED POUT *(Ameiurus nebulosus)*

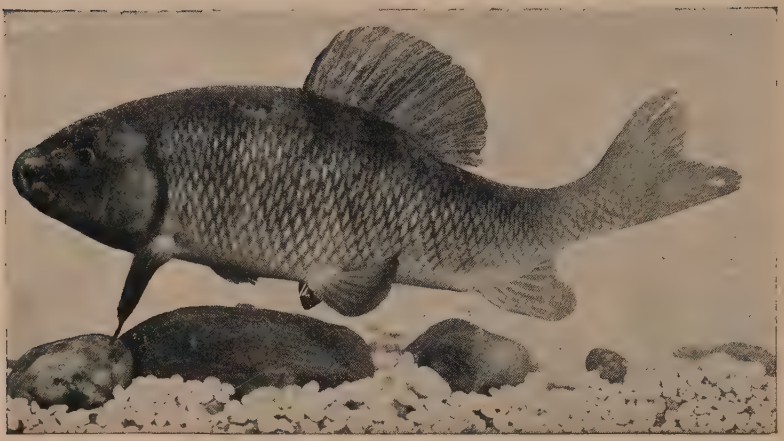


SUCKER *(Catostomus commersonii)*

as Bullhead and Horned Pout, is common throughout the middle and eastern states and has been introduced in California, where it is now abundant. Great numbers are sold in the Chinese markets in San Francisco, and its food value in the east is important. After the eggs of the catfish have hatched, the old fishes lead the young in schools, caring for them as the hen for her chickens. Over thirteen million pounds of catfishes are sold yearly. According to negro philosophy "A catfish on the line is worth more than a whale in the water."

One of the attractions of the Aquarium some years ago was a sixty-pound specimen of the Mississippi Catfish (*Ictalurus furcatus*), which lived in the building four years. This is one of the really big fishes of the Mississippi Valley and Gulf States, and has been known to weigh over one hundred pounds. This fish ate only during the warmer months, taking no food whatever in winter.

The abundant and well-known Yellow Cat (*Ameiurus natalis*) belongs to the eastern and middle states. Its length does not exceed two feet. The Aquarium has kept specimens more than three years. Like other small catfishes, it is known as a "bullhead."



CHUB SUCKER *(Erimyzon sucetta)*

SUCKERS—Catostomidae.

When it comes to fish catching, the Sucker (*Catostomus commersonii*) must be considered in a class by itself. It pays little attention to the baited hook, but all boys who have loitered about the streams know how to take it with wire snares. It may be found anywhere in the eastern and middle states, and ascends rocky streams to spawn.

The Chub Sucker (*Erimyzon sucetta*) is almost as well known as the common sunfish. The male in the spring has horny tubercles on the head and one of the names applied to it is Horny Chub. It is a bottom feeder, and has the habit of supporting itself on the bottom, like the darter, by means of its paired fins. This fish is widely distributed in the eastern and middle states.

The handsomest of all the suckers is the Redhorse (*Moxostoma aureolum*), which is brought to the Aquarium from the Great Lakes. It attains a weight of five or six pounds, but is not considered a choice food fish.

The largest of the sucker tribe is the Buffalo-fish (*Ictiobus cyprinella*), from the large rivers of the Mississippi Valley, and specimens weighing fifty pounds have been taken. It is the most abundant native food fish of the region and millions of pounds are sold yearly. It feeds largely on aquatic crustacea, insects and plants.

QUILLBACK *(Carpiodes velifer)*

The Quillback (*Carpiodes velifer*) of the Mississippi Valley is often to be been in our collectons. It rarely exceeds a foot in length and has little commercial value. The prolonged first dorsal ray gives it its name. It belongs to the group of fishes called carp-suckers, and abounds in sluggish waters, where it does much rooting in the mud. Specimens have lived in the Aquarium three years.

CARPS and MINNOWS—Cyprinidae.

The Carp (*Cyprinus carpio*), a native of Asia and introduced into Europe, was from there introduced into America where it has become widely distributed and enormously abundant. There are three principal varieties, known as Scale, Mirror and Leather Carp. The first is fully scaled, the second has a few large scales, and the last is nearly scaleless. Old specimens that have been kept under favorable conditions in Europe have been reported to weigh as much as ninety pounds. The food of the carp is chiefly vegetable. Anglers have always complained about the introduction of the carp into our waters but its remarkable fecundity has made it so abundant that its value as a food fish outweighs all objections. Carp from certain western localities such

FRINGE-TAILED GOLDFISHES

as the Illinois River and the southern part of Lake Erie, are now being shipped by the carload to New York, Philadelphia, and other eastern cities, where many millions of pounds are consumed yearly. Young carp are known to constitute an important part of the food of black basses and other predatory fishes which have become more numerous in many localities since carp were introduced.

The world's favorite fish for small aquaria is the well known Goldfish (*Carassius auratus*), which has various forms and colors produced by breeding. The cultivation of goldfishes is an important industry in Japan, where such fancy varieties as "fan-tail," "fringe-tail," "lion-head" and "telescope" have been developed. The goldfish, native of China and Japan, is a near relative of the carp, and was taken to England in the 17th century. Its rearing for aquarium purposes is now carried on extensively in the United States.

The Golden Ide (*Idus idus*) was introduced from Europe as an ornamental fish for small ponds. It has been bred at fish hatcheries, but does not increase in our climate.

The Horned Chub (*Semotilus atromaculatus*) is an inhabitant of the brooks and small creeks, where it is also

COMMON ROACH *(Abramis crysoleucas)*

generally the largest inhabitant. It is an active and voracious little fish ready to bite at most of the baits known to the country boy, such as grasshoppers, soft caterpillars and beetles, to say nothing of earthworms. No pan fish tastes better. It is a nest builder, carrying pebbles to the shallow excavations where the eggs are deposited.

Although only of minnow size, the Stone Roller (*Campostoma anomalum*) is anatomically somewhat of a celebrity; its genus, alone of all fishes, having the long intestine wound around the air bladder. It is widely distributed and is well known for its habit of carrying fine gravel to its nest. The stone roller runs up the brooks at spawning time in large numbers. It is a good fish to keep in small aquaria.

The Roach or Golden Shiner (*Abramis crysoleucas*) is widely distributed throughout the eastern and middle states. Anglers value it as a bait fish, and it is useful in ornamental ponds in destroying mosquito larvae. The roach is abundant in the park lakes of New York City. It is a hardy fish for keeping in small aquaria and one of the best fishes that can be introduced into private ponds as a food supply for larger fishes.

PEARL ROACH *(Scardineus erythrophthalmus)*

A very attractive fish that is always to be seen in the Aquarium is the European Rudd or Pearl Roach (*Scardinius erythropthalmus*). It was introduced from Europe, but the history of its introduction is unknown. Until quite recently it was found only in the lakes in the parks of New York City, where it has long been abundant. The rudd is a food fish, sometimes weighing two pounds. It is distinguishable at all ages from the native roach by the vermillion color of the fins.

Another European fish introduced to a limited extent into American waters is the Tench (*Tinca*), a food fish occasionally weighing several pounds. It is a hardy species that, like the carp, can live many hours out of water. The tench is often found with a bright golden color.

EELS—Anguillidae.

The Eel (*Anguilla chrysypa*), here mentioned among freshwater fishes, might also be included among the marine species, but most of its life is spent in rivers, which it follows far inland. It penetrates streams flowing into the Ohio and upper Mississippi. Unlike shad and salmon, which are sea fishes entering fresh waters to spawn, the eel's habit is quite

the reverse, as it descends from the rivers to spawn in the sea. The eel is generally taken in traps or fish pots, and millions of pounds are consumed every year.

SALMON, TROUTS, WHITEFISH and GRAYLING—Salmonidae.

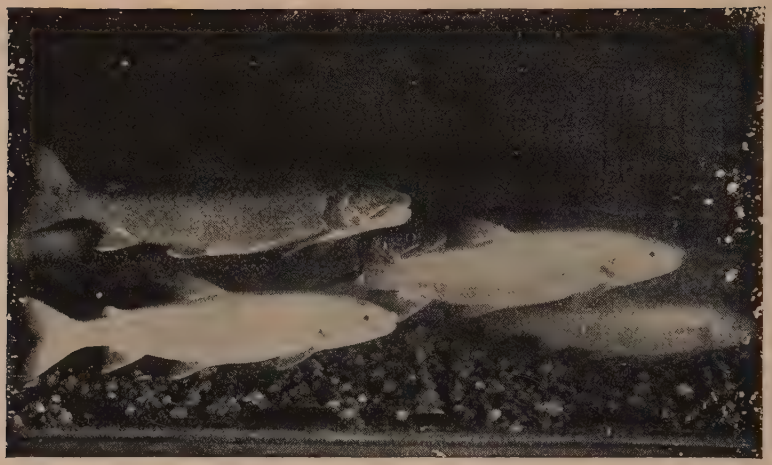
The Quinnat Salmon (*Oncorhynchus tschawytscha*) is also known as King Salmon and Columbia River Salmon. It is found along our Pacific Coast from California to Bering Straits. The average weight of this fish is twenty pounds, but it has been known to reach a weight of one hundred pounds. The Pacific salmons, of which there are five species, are the most valuable of all fishes. Many millions of dollars' worth are canned yearly. The Pacific salmons to be seen in the Aquarium from time to time are hatched here from eggs sent in small refrigerator boxes from Government hatcheries in California.

The Atlantic Salmon (*Salmo salar*) is a North Atlantic species, ascending the rivers of northern Europe and North America. It is said to have been found formerly in the Hudson River, which, if true, was its southern limit. Two landlocked varieties of this salmon are found in northern lakes. Its weight is from ten to twenty pounds, but specimens of eighty pounds have been recorded. The Atlantic salmon is the noblest of food and game fishes.

The Landlocked Salmon (*Salmo salar sebago*) is often called the Sebago Salmon. It is found naturally in some of the lakes of Maine, New Hampshire and Vermont, and from there northward. It has also been extensively introduced into other northern waters. The landlocked salmon is a fresh-water variety, not being migratory like the sea salmon. It has been known to reach a weight of twenty-five pounds, and ranks high as a game fish.

The Humpback Salmon (*Oncorhynchus gorbuscha*) is an inhabitant of the Pacific Coast from California to the Arctic Ocean, and is very abundant in the smaller streams of Alaska. The males in the fall develop a fleshy hump which gives the fish its name. This is the smallest of the Pacific salmons. Its eggs have been hatched in the Aquarium and the young kept several years.

The Sunapee or Golden Trout (*Salvelinus aureolus*).



BROWN TROUT. Several of these are albinos.

handsomest of our eastern trouts, is an inhabitant of Sunapee Lake, New Hampshire, and lakes of the adjacent region. It is closely related to the European charr. The Sunapee trout inhabits deep, cold water. The name golden trout is now generally applied to another species found in the high sierras of California.

The Brown Trout (*Salmo fario*) has been introduced extensively from Europe into American waters. It is a food and game fish of decided importance, but is not as popular with anglers as our more active native trouts. The brown trout sometimes attains a weight of twenty pounds. In our waters it spawns from October to January. Like other trouts it feeds on insects and their larvae, worms, freshwater mollusks and small fishes.

The Lake Trout (*Cristivomer namaycush*), also called Mackinaw Trout, is an inhabitant of the Great Lakes and lakes of New York, its distribution extending northward to Alaska, where the writer has taken specimens above the Arctic Circle. This is the largest of the trouts and is said to have been found weighing as much as one hundred pounds. It is a valuable food fish, millions of pounds from the Great Lakes being sold yearly. It is usually taken by anglers by trolling.

YEARLING RAINBOW TROUT

The Rainbow Trout (*Salmo irideus*), also called Salmon Trout, is now known to be identical with the Steelhead Trout. It is an inhabitant of the Pacific Coast from California to Alaska, and has been introduced widely into eastern waters, being now common in some of the Great Lakes, from which it ascends streams. It goes up the Columbia River as far as Idaho. This is a large species, sometimes weighing thirty pounds. The "steelhead" is shipped to market in considerable quantities and on the Pacific Coast is considered the best native game fish.

Black-spotted Trout (*Salmo pleuriticus*). The black-spotted trouts inhabit the entire Rocky Mountain region. They are divided into several species, according to the waters in which they are distributed, and are known by several names such as Cut-throat, Rocky Moutain, Yellow-stone trout, etc. In some waters they weigh as much as eighteen pounds. The black-spotted trouts are excellent game and food fishes. Unlike most other American trouts, they spawn in spring and early summer. The fish eggs to be found in the Aquarium hatchery in summer are exclusively those of the black-spotted trouts.

WHITEFISH *(Coregonus clupeiformis)*

The Brook or Speckled Trout (*Salvelinus fontinalis*) is the most beautiful and best known of American trouts. It inhabits naturally cold, clear streams and lakes from Maine to Georgia and throughout the Great Lakes region and has been introduced into western waters. Under favorable conditions the brook trout attains a good size and is said to have reached a weight of ten pounds in the Rangeley Lakes. It is easily handled in fish hatcheries and has long been extensively propagated by artificial means.

The Grayling (*Thymallus tricolor*) is a northern fish which inhabits the Au Sable and other rivers of Michigan, certain waters in Montana, and is being introduced elsewhere in the northern states. This species has become scarce in Michigan as a result of lumbering operations and over-fishing. Its northern range extends beyond the Arctic Circle. The grayling is one of the daintiest and rarest of game fishes.

One of the most important food fishes of the country is the familiar Whitefish (*Coregonus clupeiformis*). It was formerly enormously abundant in the Great Lakes, and millions of pounds are still marketed yearly, strenuous efforts being made to keep up the supply by artificial propaga-

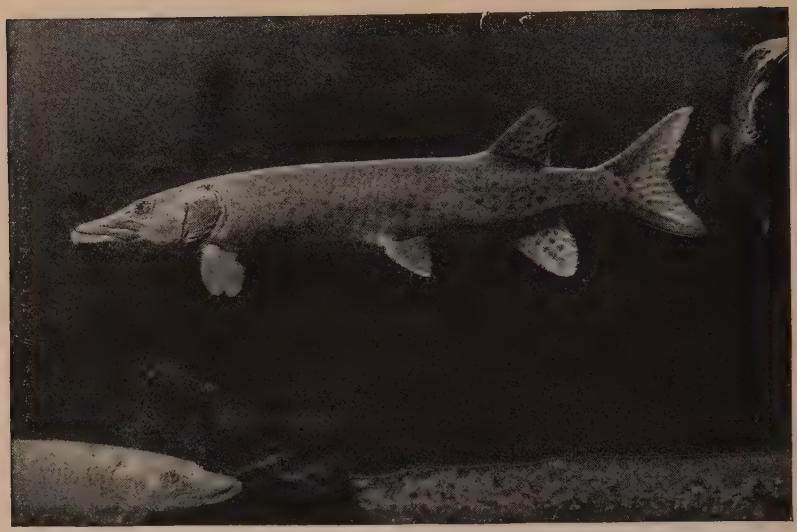
CHAIN PICKEREL *(Lucius reticulatus)*

tion. The whitefish sometimes reaches a weight of twenty pounds. The eggs and young are often to be seen in the hatchery of the Aquarium, and specimens reared here have lived in the building several years. There are many species of whitefishes in northern waters.

PIKES and PICKERELS—Luciidae.

The Pike (*Lucius lucius*) is an inhabitant of northern Europe, Asia and America. Its American range is from New York to the upper Mississippi Valley and northward to Alaska. It is a fish of large size, sometimes weighing forty pounds, voracious and quite destructive to other fishes. A food and game fish of importance, the pike is described by Izaak Walton as "too good for any but anglers and honest men."

The Chain Pickerel (*Lucius reticulatus*), also called Jack, or Green Pike, is found from Maine to Florida, east of the Allegheny Mountains, and also in the Mississippi River. It is abundant in the lakes of New York. The chain pickerel, like the pike, is a very predaceous fish, though smaller, its length not exceedingly two feet and its weight eight pounds. It is a well known game fish.



MUSKALLUNGE *(Lucius masquinongy)*

The Banded Pickerel (*Lucius americanus*) belongs only to the region east of the Alleghanies, from Massachusetts southward inhabiting lowland streams and swamps. It is too small to be of much importance for food, being seldom more than a foot in length. It is often found in brackish water in the vicinity of New York. This species is distinguished from the chain pickerel by numerous vertical dark bands, while the latter has dark lines forming a net-work pattern.

The largest of the pike family is the Muskallunge (*Lucius masquinongy*), which is found from the lakes of New York, the Great Lakes and the Mississippi Valley, northward. It sometimes attains a weight of one hundred pounds, and is a splendid game fish, usually taken by trolling with live fish bait. Large specimens exceeding four feet in length and weighing thirty pounds, have lived in the tanks of the Aquarium ten years.

KILLIFISHES—Poeciliidae.

The Killifish (*Fundulus diaphanus*), although of only minnow size, renders an excellent service to man as an active destroyer of the larvae of mosquitoes, the fresh-water

LONG-EARED SUNFISH *(Lepomis megalotis)*

"killy" being one of the best species for eliminating the mosquito nuisance in ornamental ponds. The killifish is also important as food for other fishes. It is found from Maine to North Carolina, and is abundant in some of the lakes of New York City.

BLIND FISHES—Amblyopsidae.

The Blind Fish of the Mammoth Cave (*Typhlichthys subterraneus*) has more than once found its way to the Aquarium and lived there two years. It is a small fish, less than three inches long and colorless as an albino. Feeding freely on mosquito larvae in summer and small amphipod crustaceans in winter, it seems to be quite unaffected by its change from the great cavern to the world of light.

STICKLEBACKS—Gasterosteidae.

The Brook Stickleback (*Eucalia inconstans*), found in small streams throughout the northeastern states, is a small fish only a couple of inches long, but active and abundant. The males develop much bright red color in spring. Sticklebacks are favorite fishes for small aquaria, as they construct nests of water plants to hold their eggs, which are actively guarded by the male.

YOUNG BLUE-NOSED SUNFISH *(Lepomis pallidus)*

PIRATE PERCHES—Aphredoderidae.

The Pirate Perch (*Aphredoderus sayanus*) is a small fish three or four inches long, ranging from New York, westward. It inhabits quiet waters, living in the shelter of aquatic plants. At spawning time the nest is guarded by both parents.

SUNFISHES and BASSES—Centrarchidae.

The Long-eared Sunfish (*Lepomis megalotis*) is one of the most brilliant of the sunfishes. It comes from west of the Alleghanies and has lived three years in captivity.

The Blue-nosed Sunfish (*Lepomis pallidus*) is the largest of the sunfish group and sometimes weighs two pounds. In warm southern waters it grows larger than in the north. It is widely distributed over the eastern states, but is not found north of New Jersey on the Atlantic Coast. Specimens are occasionally to be seen in the tanks of the Aquarium.

Thoreau says that the Red-Breasted Sunfish (*Lepomis auritus*) is "seen on every urchin's string." It may be found all the way from Maine to Louisiana, and is common in streams near New York City. Like all the sunfishes, the red-breast makes nests in shallow water along shore. Although small, it is good to catch and good to eat.

ROCK BASS *(Ambloplites rupestris)*

The Sunfish (*Eupomotis gibbosus*) is probably better known to the boy with a fishing rod than any other fish in our native waters. Pumpkin Seed is one of the many names he gives it. On account of the small size of the sunfish its food value is limited. Building saucer-shaped nests in shallow water, which the male carefully protects, it is more easily observed than any other wild fish, and its ways are well known. The sunfish should not be introduced into ponds where food fishes are to be raised. It becomes very abundant, and besides having little food value on the table, is not well adapted as a food supply for more important fishes.

Another sunfish which has been brought to the Aquarium is the Warmouth (*Chaenobryttus gulosus*). It is found west of the Alleghanies and also along the Atlantic slope from North Carolina southward. It inhabits sluggish waters and is well known to anglers.

One of the smallest and handsomest of the sunfishes is the Banded Sunfish (*Mesogonistius chaetodon*). It has a rather limited range, being found only from New Jersey to North Carolina. Its length is seldom over nine inches. The band-

LARGE-MOUTHED BLACK BASS (First dorsal lowered)

ed sunfish inhabits sluggish streams and is always found among water plants. It has been successfully kept in small aquaria, where it seems to require insect larvae, small crustacea and other live food. Specimens have been kept in the New York Aquarium three years.

The Mud Sunfish (*Acantharcus pomotis*) is found in sluggish streams near the coast, from New York, southward. This is a seclusive fish very little in evidence, and may be more numerous than it appears to be. It has lived eight months in the Aqarium tanks. Its color is greenish, with broad lengthwise bands.

A fish dear to young anglers is the Rock Bass (*Ambloplites rupestris*), often called Red-eye and Goggle-eye. It may be found in suitable waters almost anywhere in the eastern and middle states. It is not often found as heavy as three pounds, but is gamy to catch and excellent for the table. The rock bass is a species well adapted for the home fish pond.

There are few fishes more popular with anglers than the black basses. The Large-mouthed Black Bass (*Micropterus*

CRAPPIE *(Pomoxis annularis)*

salmoides), also called Oswego and Grass Bass, is widely distributed through our eastern states and westward to Minnesota and Texas. Artificial propagation has greatly extended its range. The maximum weight of the large-mouthed bass is about twelve pounds.

The Small-mouthed Black Bass (*Micropterus dolomieu*) is considered the pluckiest of American game fishes and is one of the most popular with anglers. Like the large-mouthed bass, its naturally wide range has been greatly extended by cultivation. The small-mouthed bass lends itself readily to pond culture. The spawning nests are actively protected by the male fish. The markings of this species vary greatly according to locality.

The Calico Bass (*Pomoxis sparoides*) has several names, the commonest of which are Strawberry and Grass Bass. It is found from New Jersey to the Great Lakes and southward to Texas, and has been introduced into many parts of the country which it did not inhabit originally. Being a good food and game fish distributed for cultivation in small ponds, it is now well known throughout the eastern states.

PIKE PERCH *(Stizostedion vitreum)*

The Crappie (*Pomoxis annularis*), which looks much like the calico bass, has local names too numerous to mention. It has about the same natural distribution and has been introduced elsewhere for the same reasons—that it is a good food and game fish and multiplies rapidly in small ponds.

PERCHES—Percidae.

A food and game fish which is extensively propagated in government and state hatcheries, is the Pike Perch (*Stizostedion vitreum*), often called Wall-eyed Pike. It is found from the Mississippi Valley and Great Lakes, northward, extending south on the Atlantic Coast as far as Georgia. It is a fish of considerable importance in our markets. Specimens weighing twenty pounds have been taken in the Great Lakes, but the average is less than ten pounds.

A fish of similar appearance is the Sauger (*Stizostedion canadense*), also called Sand Pike and Jack. Its natural range from the St. Lawrence River to Montana and Arkansas has been considerably extended by fish culturists. This fish is merely a smaller relative of the pike perch. It reaches a length of about eighteen inches and is extensively used for food.

A medium sized fish of more than medium importance

YELLOW PERCH *(Perca flavescens)*

is the Yellow Perch (*Perca flavescens*), of the northern United States. More than ten million pounds of this fish are marketed annually and great quantities are caught by anglers everywhere. The yellow perch lays its eggs in large masses in shallow water along shore, and is easily propagated in ponds. Hundreds of thousands are hatched yearly in the New York Aquarium and planted in local waters.

There are many kinds of tiny darters inhabiting the brooks everywhere, one of which is the Tessellated Darter (*Boleosoma nigrum olmstedi*). It has been kept for three years at a time, but such little fishes are rather overlooked among the big ones in the Aquarium. This species, found from Massachusetts to Georgia, is common near New York City. Many of the darters have brilliant colors and some of them can be kept in small aquaria.

BASSES—Serranidae.

A good food and game fish of the Great Lakes and Mississippi River regions, is the White Bass or Lake Bass (*Roccus chrysops*). It is often to be seen in western markets and may reach a length of fifteen inches. The white bass is a good species for stocking small ponds and rises well to the angler's artificial fly.

WHITE BASS *(Roccus chrysops)*

The Fresh-water Drum (*Aplodinotus grunniens*) is found from New York and the Great Lakes to Texas and bears a different name in each state. Although not one of the best fishes, it is much used for food. Large specimens weigh forty pounds or more. It is a bottom fish, feeding largely

FRESH-WATER DRUM *(Aplodinotus grunniens)*

BURBOT *(Lota maculosa)*

on crayfish and small shells, which its blunt paved teeth easily crush. Like its relative the salt-water drum, it makes the noises which give both fishes their common name.

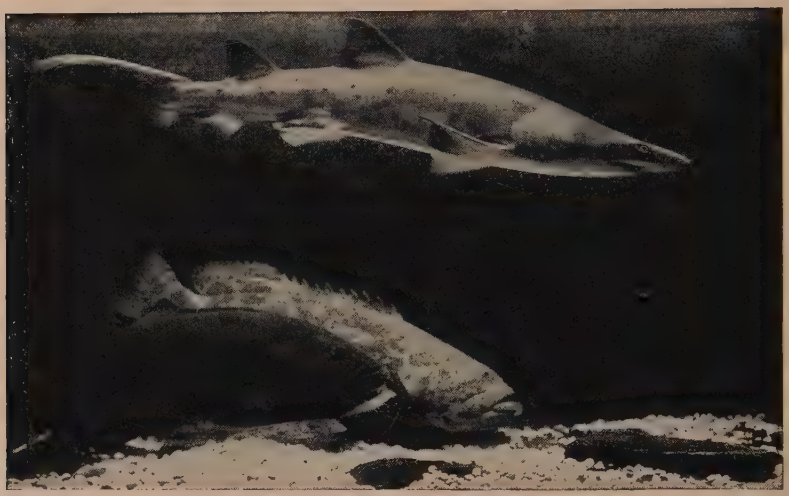
CODFISHES—Gadidae.

The only fish of the cod family living in fresh water is the Burbot (*Lota maculosa*), also called Ling and Fresh-water Cusk. It ranges from our northern states to Alaska. Specimens weighing sixty pounds have been taken in the Yukon River, where it is a valuable food fish to the natives. This excellent fish long neglected in our waters, is now being marketed in important quantities.

MARINE FISHES

LAMPREYS—Petromyzonidae.

The Sea Lamprey (*Petromyzon marinus*) is a species which ascends streams to spawn and dies after spawning. Its rounded mouth is adapted for suction and the lancet-like teeth are arranged in circles. It attaches itself to and feeds on other fishes. The sea lamprey and the fresh-water lamprey (*Petromyzon marinus unicolor*), are both very destructive. The latter is common in the lakes of New York and does not descend to the sea.



SAND SHARK, JEWFISH AND GROUPER

SHARKS, SKATES and RAYS—Selachii.

Sharks are frequently to be seen in the Aquarium, but large specimens never live more than a few days in captivity. Young sharks are better adapted for exhibition and the Sand Shark (*Carcharias littoralis*) has lived for two years in one of the large floor pools. This species, which reaches a length of about nine feet, is common in local waters and specimens three or four feet long do well in confinement.

The Blue Shark (*Carcharias milberti*) has been kept three weeks, the specimens being about seven feet in length.

The Hammerhead Shark (*Sphryna zygaena*), remarkable for the position of its eyes, which are placed at the lateral extremities of the hammer-shaped head, has been exhibited for a short time.

Large specimens of the Nurse Shark (*Ginglymostoma cirratum*) do not long survive, but the Aquarium has kept specimens of the young from Florida for two years. This species, although reaching a length of ten feet, has a very small mouth and is an entirely harmless shark.

The following small species are easily obtained and have lived for months: The Smooth Grayfish (*Mustelus canis*), abundant on our Atlantic coast south of Cape Cod, reaches

COMMON SKATE *(Raia erinacea)*

a length of about three feet. This fish, formerly used only for oil and fertilizer, has recently come into general use as food, and quantities are now being marketed fresh.

The Grayfish (*Squalus acanthias*), abundant along the Atlantic coast from Newfoundland to Cape Cod during the summer and early fall, migrates in the late fall to the southward, occurring in comparative abundance as far south as the coast of North Carolina. This fish has recently been placed on the market, canned, and a closely related species is packed on the Pacific coast. It is wholesome, nutritious and palatable, and within a few months of its introduction had become an important food product.

The Common Skate (*Raia erinacea*) is the smallest skate found along our coast, ranging from one to two feet in length. It is also called Prickly Skate on account of the numerous spines on the upper surface of the body.

The Barndoor Skate (*Raia laevis*) is the largest species of the north Atlantic coast, reaching a length of four feet. It is common in the New York region and is often to be seen in the Aquarium. The large pectoral fins of skates are much used for food, especially in foreign countries.

The Big Skate (*Raia ocellata*) resembles the common

skate in appearance and is similarly covered with spines. Skates lay their eggs in leathery, rectangular-shaped cases, which are often washed ashore and are popularly known as mermaids' purses.

The Sting-ray (*Dasyatis centrura*) is celebrated for the sharp bony spine on the top of its tail, with which it often inflicts dangerous wounds. The tail is long and whip-like, and the fish sometimes reaches a total length of eight feet. This species is more or less abundant from Maine to North Carolina. Other kinds of sting-rays are found farther south.

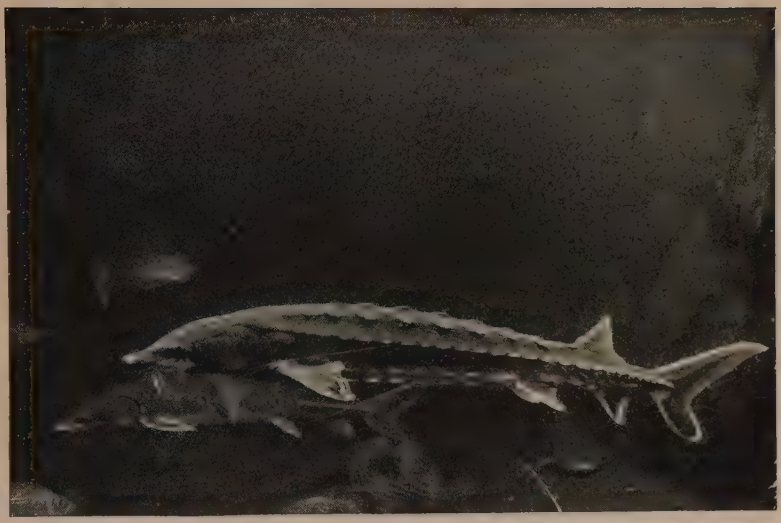
The Electric Ray or Torpedo (*Tetronarce occidentalis*) occurs all along the Atlantic coast of the United States, though not common in New York waters, and reaches a weight of about 100 pounds. Provided with an electric organ located near the head, it is capable of giving powerful shocks when handled or even touched with a stick. It is hard to transport alive and has seldom been brought to the Aquarium.

Other rays often to be seen in the Aquarium are the Cow-nosed Ray (*Rhinoptera bonasus*), and the Butterfly Ray (*Pteroplata maclura*). Both are fairly common along our coast.

STURGEONS—Acipenseridae.

The largest sea fish entering our rivers is the Common Sturgeon (*Acipenser sturio*), which spawns in all of the larger rivers from Maine to Florida. It has been known to weigh as much as five hundred pounds, and like the lake sturgeon, is valued more for its eggs than its flesh. The sturgeon fishery of the United States including the species of the Great Lakes and the Pacific Coast, formerly yielded several million pounds of products a year, but the catch is now deplorably reduced. Specimens of this species have lived in the Aquarium four years.

The Short-nosed Sturgeon (*Acipenser brevirostris*) has about the same range as the large common sturgeon, entering streams from Massachusetts to the Gulf of Mexico. Its length does not exceed three feet. This species, although frequently taken in pound nets, is not extensively used for food. The short-nosed sturgeon lives well in captivity.



COMMON (upper) and SHORT-NOSED STURGEONS

SEA CATFISHES—Siluridae.

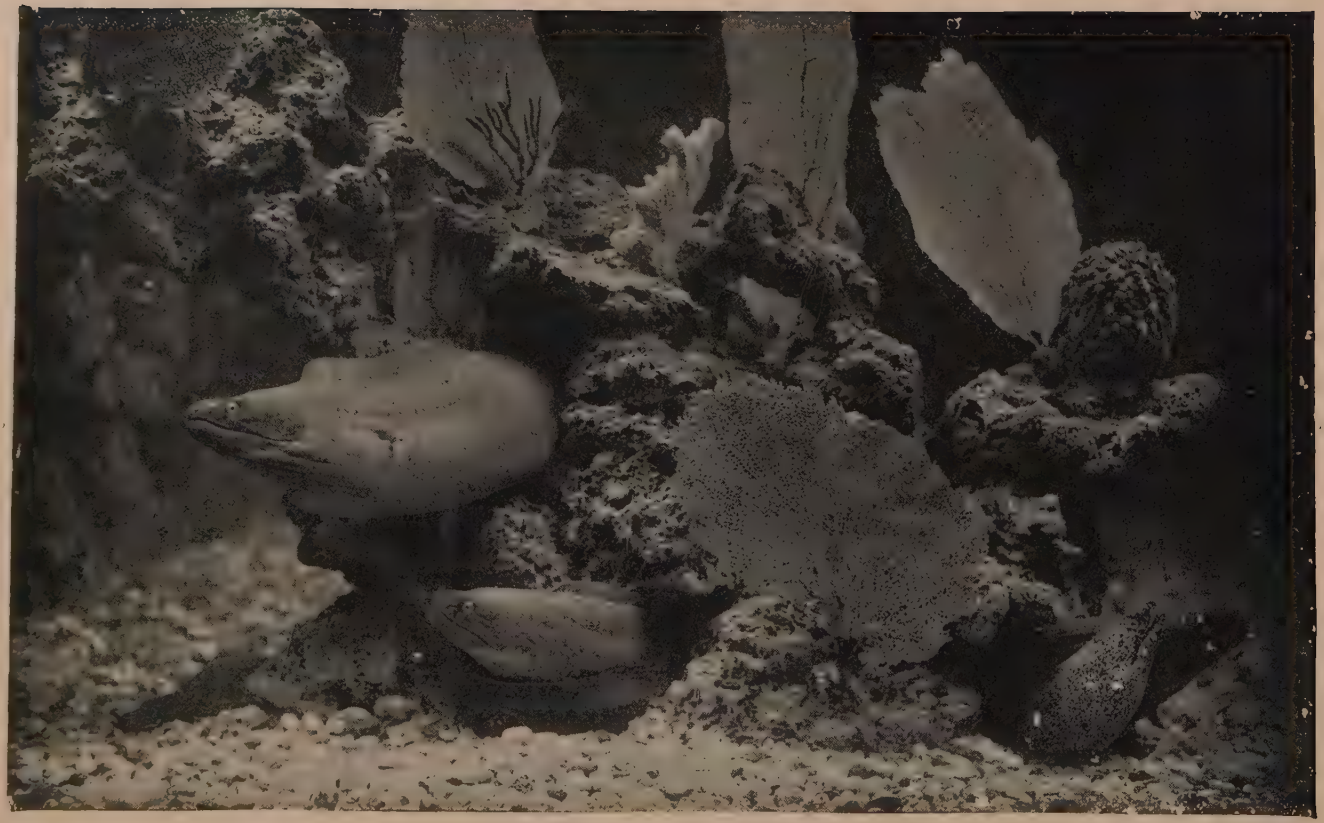
The Sea Catfish (*Hexanematichthys felis*) of the Atlantic and Gulf Coasts, sometimes entering New York Bay, is interesting on account of its habits. The eggs, few in number but of large size, are carried in the mouth of the parent fish until hatched.

CONGER EEL—Leptocephalidae.

The Conger Eel (*Leptocephalus conger*) is found nearly all over the world, and is common along our coast. It is of little food value in the United States, but is used extensively in the old world. It reaches a length of seven or eight feet.

MORAYS—Muraenidae.

The Green Moray (*Lycodontis funebris*) is one of the most conspicuous fishes to be seen in the Aquarium, where specimens five or six feet long have lived for several years. The green moray is a very active fish with sharp and dangerous teeth, and requires careful handling when dragged into the fisherman's boat. Its color is a brilliant, uniform green. Usually kept with it in the tanks is the Spotted Moray (*Lycodontis moringa*), which is of smaller size and conspicu-



GREEN AND SPOTTED MORAYS

ously spotted. Both species belong to the Florida and West Indies region. A much rarer species is the Banded Moray (*Channomuraena vittata*), with numerous vertical bands. The only specimen ever received at the Aquarium came from Bermuda.

TARPONS—Elopidae.

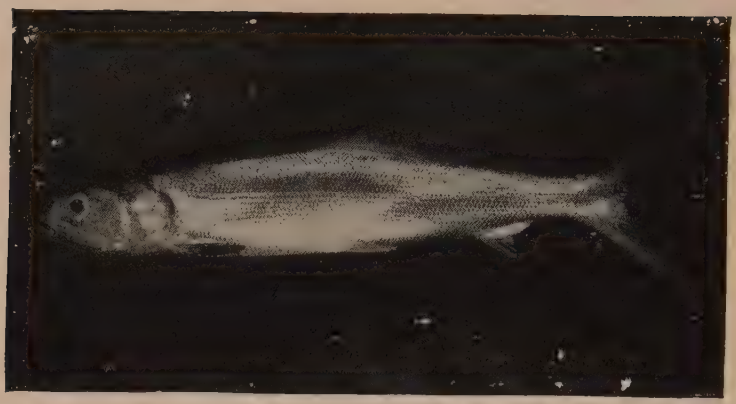
The Tarpon (*Tarpon atlanticus*), during comparatively recent years, has become celebrated as one of the big game fishes of the sea, affording excellent sport to the angler, though little valued as food. It reaches a length of six feet and fights actively when hooked, making splendid leaps from the water. The tarpon belongs to the Florida and West Indies region, wandering northward in summer. The scales of this fish are unusually large, thick and silvery. Several specimens captured in New York Bay in summer have been exhibited at the Aquarium.

The Ten-pounder (*Elops saurus*) is a cousin of the tarpon, which it resembles superficially but lacks the large scales. It is about three feet in length and has no food value. This fish inhabits both the Atlantic and Pacific coasts and is sometimes found in summer as far north as New York.

HERRINGS—Clupeidae.

One of our most important fishes commercially, entering rivers from Maine to Florida on the Atlantic coast, is the Shad (*Alosa sapidissima*). Many years ago it was introduced on the Pacific coast, where it is now equally abundant. About fifty million pounds are sold annually, and the Government maintains several hatcheries for its artificial propagation. Shad begin running in January in the St. John's River in Florida, gradually entering streams farther north until they finally reach the Hudson in March. Owing to exhaustive fishing and the ever-increasing pollution of the rivers where it spawns, it has long been decreasing in numbers.

Other fishes which, like the shad, belong to the herring family, and are seen in the Aquarium from time to time, are the Glut Herring (*Pomolobus aestivalis*), Hickory Shad (*Pomolobus mediocris*), Thread Herring (*Opisthonema oglinum*), and Menhaden (*Brevoortia tyrannus*). The men-



TEN-POUNDER *(Elops saurus)*

haden is a species of little importance as a food fish, but exceedingly valuable for oil and fertilizer. Enormous quantities are taken to factories for the preparation of these products.

The most abundant and important fish known to mankind is the Herring (*Clupea harengus*), of northern seas. It has often been styled "King Herring" on account of its preponderance in the fisheries. The annual catch in American and European waters amounts to nearly two billion pounds. The herring of the Pacific coast and Alaska is scarcely different from that of the Atlantic. On the coast of Maine great quantities of young herring are canned as sardines. Young herring are also extensively used as whitebait both in this country and Europe.

The Alewife (*Pomolobus pseudoharengus*) is found along our entire coast as far south as North Carolina. It ascends streams for spawning and is taken in great numbers with seines and fish traps. It is a valuable food fish, being used fresh, or preserved by salting and smoking.

ANCHOVIES—Engraulididae.

The Anchovy (*Stolephorus mitchilli*), found all along the Atlantic Coast, is abundant in the New York region. It is a good food fish and the young are often sold as whitebait, especially in the summer season. Anchovies are small fishes, only four or five inches long, but moving in large schools

they can be netted in considerable quantities. They are sold not only in the markets, but are used extensively as bait.

SMELTS—Argentinidae.

The Smelt (*Osmerus mordax*) is a choice food fish taken in great quantities from Virginia northward. It enters fresh-water streams to spawn. An interesting point in connection with the smelt is the fact of its being landlocked in Lake Champlain and other lakes. This fish is artificially propagated by the New York Conservation Commission at the Cold Spring Harbor fish hatchery on Long Island.

KILLIFISHES—Poeciliidae.

Three species of salt water killifish are usually to be found in the Aquarium, where they serve the double purpose of feeding fishes which require live food, and of interesting visitors with their attractive ways. The Bass Killy (*Fundulus majalis*), also called Mummichog, is the largest. It is not often that the sexes of fishes are easily distinguishable, but in this species they are conspicuously different, the females being striped lengthwise, while the males have vertical cross bars. The common Killifish (*Fundulus heteroclitus*), also called salt water minnow, is very abundant in New York Bay. The males are brilliantly colored. A third species is the Sheepshead Minnow (*Cyprinodon variegatus*), the males of which during breeding season, become ultramarine blue above and orange below. All of the killifishes are much used for bait. They are so hardy that they can be shipped to anglers considerable distances without water, and are well adapted to small marine aquaria. They are all of great importance as devourers of mosquito larvae.

NEEDLEFISHES—Belonidae.

The long-jawed and voracious Silver Gar (*Tylosurus marinus*), is difficult to transport and does not long survive in captivity. It is common along the Atlantic and Gulf coasts, entering the mouths of rivers, where it probably spawns. This fish is edible but is little used. It is strikingly elongated and slim of body and has a length of four feet.

BALAOS—Hemirhamphidae.

The elongated lower jaw of the Halfbeak (*Hyporhamphus roberti*) serves to identify it, being many times the

SHEEPSHEAD MINNOW AND STICKLEBACKS

length of the short upper jaw. It is an excellent food fish, seldom over a foot long. It moves in schools and is easily taken in nets, especially at night when lights are used. Distribution, middle Atlantic coast and southward.

STICKLEBACKS—Gasterosteidae.

The sticklebacks are represented in the Aquarium by three species which are common about New York Bay. One of these is the Two-spined Stickleback (*Gasterosteus bispinosus*). Like the killifishes, they are good fishes for small marine aquaria. The males are gorgeously marked with red in the breeding season. All of the sticklebacks are interesting on account of their nest-building habits. The nest is guarded by the male fish, which will not allow the female to approach it after the eggs are laid, and frequently kills her. The two-spined stickleback is four inches long when mature.

PIPEFISHES—Syngnathidae.

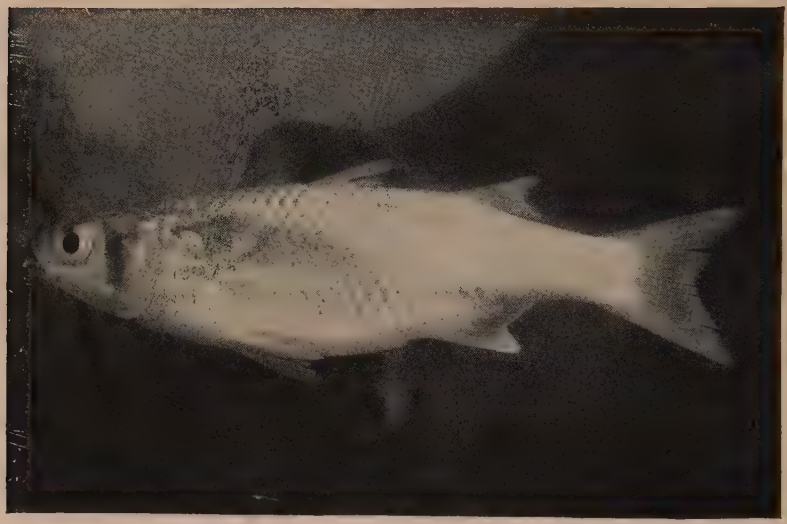
The Pipefish (*Siphostoma fuscum*), first cousin of the sea horse, provides for its young in the same way, the eggs being carried in the pouch of the male. It is a common fish, found among sea weed along shore from Massachusetts to

SEA HORSE *(Hippocambus hudsonius)*

Virginia. The tail has a small fin and is not prehensile as in the sea horse, while the whole fish is straight of body and very slim. It is protected from head to tail with bony plates.

SEA HORSES—Hippocampidae.

There is no fish in the Aquarium of more interest to visitors than the Sea Horse (*Hippocampus hudsonius*), and the interest is in inverse proportion to the size of the fish, for the largest specimens do not reach seven inches in length. It is found from Massachusetts to South Carolina, and is often taken in New York Bay. The eggs are carried in an abdominal pouch by the male until they hatch. The sea horse is the only fish provided with a grasping tail. There are many kinds of sea horses and they inhabit all warm seas. The largest known species (*Hippocampus ingens*) is about a foot long, and is found on the Pacific coast of Mexico. It is a disappointment to many persons to learn that the sea horse is not adapted to small aquaria, as it requires pure sea water and live food. Even in the large tanks of flowing sea water in the New York Aquarium it must have regular supplies of the minute crustaceans (*Gammarus*), on which it feeds.



COMMON MULLET *(Mugil cephalus)*

SILVERSIDES—Atherinidae.

A tankful of Silversides (*Menidia notata*) is an attractive exhibit. Without this fish, called Spearing in the New York region, anglers would lack one of their most alluring baits. Large numbers are seined with small-meshed nets in summer, along the adjacent ocean beaches. In winter many gather in the salt water creeks of the marshes, where they are taken in abundance with dip-nets. The young of this fish constitutes the bulk of the so-called whitebait brought to market in winter.

MULLETS—Mugilidae.

The Common Mullet (*Mugil cephalus*) is widely distributed, being found from Massachusetts to Brazil. It enters the bays, moving in large schools and making frequent leaps from the water. The mullet is a fine food fish, very abundant in the south where it is taken in great numbers and preserved by salting.

BARRACUDAS—Sphyraenidae.

There is no more fierce and voracious fish for its size than the Barracuda (*Sphyraena barracuda*). Reaching a length of six or seven feet, armed with vicious teeth, naturally

SQUIRREL-FISH *(Holocentrus ascencionis)*

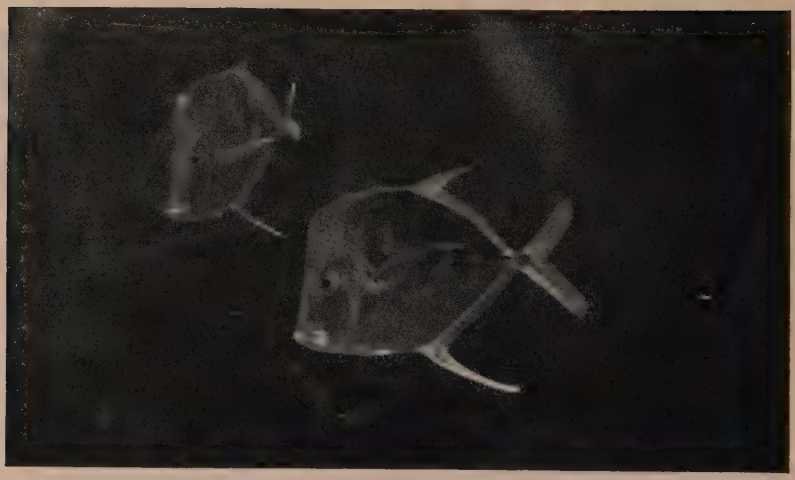
savage and active, it is a bloody pirate among fishes. It has the habit of quietly herding schools of fishes until ready to rush among them, the latter huddling together in fear. A fifty-five inch specimen taken at the Tortugas, weighed thirty-eight pounds. The outlines of the barracuda suggest those of the pike, except for the position of certain fins. Only small specimens have been received at the Aquarium.

SAND LANCES—Ammodytidae.

The Sand Lance (*Ammodytes americanus*), from five to eight inches in length, is abundant along sandy shores of the Atlantic coast, south to North Carolina, moving in large schools and much given to burying itself in sand. It is a favorite food of bluefish, eels and flounders. Terns also feed extensively on the sand lance. It is difficult to keep in captivity.

SQUIRREL-FISHES—Holocentridae.

The Squirrel-fish (*Holocentrus ascensionis*) is so golden-red that at a little distance it might be mistaken for a goldfish. It is a food fish easily taken with hook and line, and



MOONFISH *(Selsne vomer)*

is often seen in tropical markets. Large specimens may weigh eight pounds. It is found from Florida throughout the West Indies.

MACKERELS—Scombridae.

It is not easy to exhibit alive the Mackerel (*Scomber scombrus*), which moves in great schools, but prefers to keep off shore and out of the way of local fishermen. The enormous market supply of mackerel is caught at sea by vessels using great purse seines. The mackerel is the basis of a great fishery, both in Europe and America. The catch in America alone has at times exceeded a million dollars' worth a year. It never has lived more than three months in captivity, which is perhaps all that can be expected of such a wide wanderer.

Other members of this family, and no easier to keep, are the Chub Mackerel (*Scomber colias*), as excellent as the mackerel but much rarer, and the Bonito (*Sarda sarda*). Both are very active, wide ranging fishes of the open ocean.

PAMPANOS—Carangidae.

The Silvery Moonfish (*Selene vomer*) is common in summer as far north as Massachusetts. Specimens from local waters are usually to be seen in the Aquarium, where

CREVALLE *(Caranx hippos)*

the species has sometimes lived as long as five years. This fish is so compressed laterally that its unusual appearance always attracts attention. A specimen eight inches long and six inches high may be only half an inch thick. Although edible, the form of its body does not permit much weight of flesh. The moon-fish is sometimes called Horse-Head and Look-Down.

The Thread Fish (*Alectis ciliaris*) of tropical waters, is found along our coast in summer, often entering New York Bay. Some of the fin rays are developed into thread-like filaments which are much longer in the young than in the adults and several times longer than the fish bearing them.

The Pilot-fish (*Naucrates ductor*) is a species which, like the shark sucker, is confirmed in the habit of accompanying sharks and also ships. It is an oceanic fish inhabiting all warm seas, and is common in local waters in summer. It is doubtless well protected from attacks by other fishes, when seeking shelter under its large companion, the shark, and may get some scraps of food from the feasts of the latter.

The verdict of epicures is that there is no better fish than the Pampano (*Trachinotus carolinus*), which belongs to our south Atlantic and Gulf coasts. It is perhaps most abun

RUNNER *(Caranx crysos)*

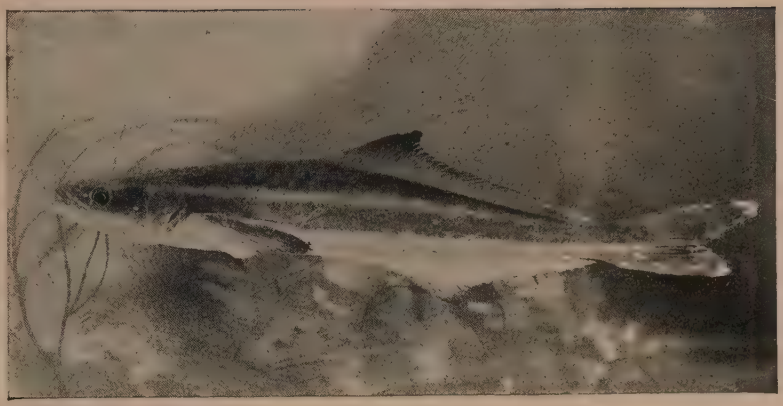
dant about Florida, where great numbers are taken in seines for market. Anglers find it rather difficult to catch. A few pampano wander north in summer and specimens have lived three years in the Aquarium. The Round Pampano (*Trachinotus falcatus*) is often kept with it and lives as long.

Three fine fishes of the West Indies region migrating northward in summer and to be seen at the Aquarium, are the Crevalle (*Caranx hippos*), about fifteen inches in length; Runner (*Caranx crysos*), a twenty-pounder; and Amberfish (*Seriola lalandi*), weighing sometimes up to one hundred pounds. All are good for food. These active fishes live three or four years in captivity, and now that many of the tanks have been trebled in size, may be expected to live still longer, having greater room for exercise.

Other members of the pampano family which the visitor may expect to meet are the Leather Jacket (*Oligoplites saurus*), Rudderfish (*Seriola zonata*), Goggler (*Trachurops crumenopthalmus*), and Blunt-nosed Shiner (*Vomer setipinnis*). Most of these are edible and all are interesting.

BLUEFISHES—Pomatomatidae.

A valuable fish providing about twenty million pounds a year for our food supply, is the Bluefish (*Pomatomus salta-*



CRABEATER *(Rachycentron canadus)*

trix). It runs in large schools, and is extremely destructive to other fishes. Bluefish trolling is a popular sport along the coast. This species averages over five pounds in weight in our northern waters, but in the south often reaches twice that size. In the New York region, specimens of less than one pound are called snappers. Bluefishes received at the Aquarium six inches in length, reached a length of twenty inches in eighteen months.

SARGEANT FISHES—Rachycentridae.

The Crabeater (*Rachycentron canadus*) is interesting because of its superficial resemblance to the shark sucker although in no way related to it. It reaches a length of five feet and is edible, but not much esteemed. It is found in New York waters in summer. More than twenty crabs have been taken from the stomach of one fish.

RUDDER-FISHES—Centrolophidae.

The Black Pilot (*Palinurichthys perciformis*), also called Rudder-fish, Log-fish and Barrel-fish, gets its various names from the habit of gathering under becalmed vessels, floating spars and barrels. It is even found inside the barrels. It is doubtless attracted by the crustaceans and other invertebrate life accumulating about drifting wreckage. This fish is found from Maine to North Carolina—off shore rather than in the bays.

YELLOW-FIN GROUPER *(Mycteroperca venenosa)*

FIATOLAS—Stromateidae.

An abundant summer fish well known to New York anglers along the wharves is the Butterfish (*Rhombus triacanthus*). Great numbers are taken in pound nets and sent to market. This fish is found along the coast from Maine to North Carolina. Although small, it is of excellent flavor. The name Harvestfish is often applied to it. The young of the butterfish have the habit of seeking shelter under floating jellyfishes.

ROBALOS—Centropomidae.

The Snook (*Centropomus undecimalis*) gets its inharmonious name from *snoek,* the Dutch for pike. It is the largest and most important of its genus, reaching a length of four feet and having white flaky flesh like that of the striped bass. The name Robalo, also applied to it, is Spanish for bass. Its outlines suggest those of the pike-perch. It is a very active game fish highly appreciated by anglers and is often taken by trolling. Habitat, Gulf of Mexico and West Indies.

SEA BASSES, GROUPERS, ETC.—Serranidae.

The larger members of this large family common to our

SCAMP *(Mycteroperca phenax)*

collections are the Yellow-fin Grouper (*Mycteroperca venenosa*), Black Rockfish (*Mycteroperca bonaci*), Princess Rockfish (*Mycteroperca olfax*), Scamp (*Mycteroperca phenax*), and Gag (*Mycteroperca microlepis*). The last is as yet known only from Bermuda, Florida and North Carolina. There are others too numerous to be described here. The groupers are large-sized food fishes, abundant from Florida throughout the West Indies. They figure prominently in tropical markets and some afford considerable sport in their catching. Their color changes are remarkable, most of which are made instantaneously.

The smaller members being still more brilliantly colored, attract more attention in captivity. The Rock Hind (*Epinephelus adscensionis* and the Red Hind (*E. guttatus*) range northward to the Carolinas. The Coney (*Bodianus fulvus*) is represented by several varieties different somewhat in color and all capable of individual color variations. All are used for food.

The Jewfiish (*Promicrops itaiara*) is one of the largest food fishes of the Florida and West Indian regions, reaching a weight at times of five hundred pounds. The Aquarium has had specimens weighing three hundred. These

CONEY *(Bodianus fulvus,* var *punctatus)*

large fishes endure captivity well and there are now jewfish in the building which have been on exhibition seven years.

An important market fish is the Sea Bass (*Centropristes*

SEA BASS *(Centropristes striatus)*

STRIPED BASS *(Roccus lineatus)*

striatus), which is caught in abundance from Massachusetts to North Carolina. Large specimens weigh four or five pounds. Over three millions of pounds of sea bass are taken yearly along the Atlantic coast.

One of the finest sea fishes entering our rivers to spawn is the Striped Bass (*Roccus lineatus*), often called Rockfish. On the Atlantic coast its range is from Maine to Florida. One of the great successes of modern fish culture has been achieved with this species. It was introduced into California many years ago, where it is now more abundant, perhaps, than on the Atlantic coast. Striped bass have been taken in eastern waters weighing one hundred pounds. This is a most important market fish, several million pounds being sold yearly, and it affords to sportsmen the finest of sea fishing. It has shown a remarkable capacity for living in captivity. Several two-year-old specimens placed in the tanks of the New York Aquarium at its opening in 1896, lived here sixteen years, one specimen surviving nineteen years. Other specimens raised in the Aquarium lived nine years.

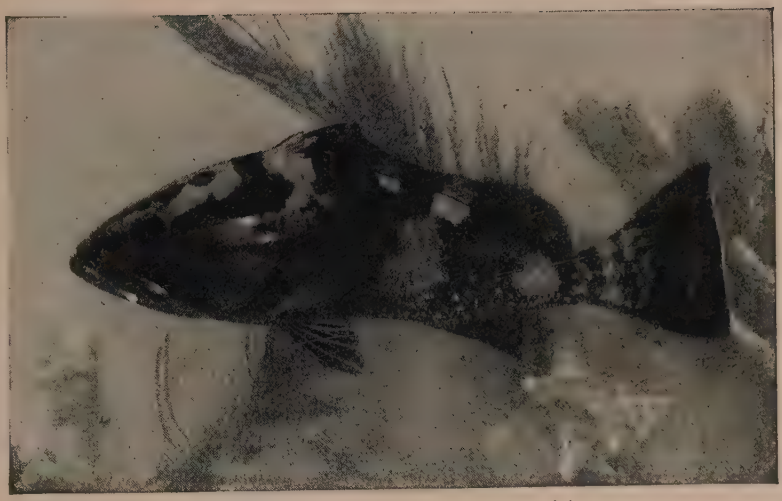
The Graysby (*Petrometopon cruentatus*), of the Bermudas, Bahamas and Florida, is a small but valued food fish, usually less than a foot in length. It is a very active species and beautifully colored, being reddish-gray with bright vermillion spots.

YOUNG WHITE PERCH *(Morone americana)*

The White Perch (*Morone americana*) is found in the Atlantic coast region from Nova Scotia to South Carolina, and is common in both fresh and brackish waters. It can be taken with the artificial fly, and is good for food. It lives in some of the park lakes of New York City.

A "regular boarder," the Nassau Grouper (*Epinephelus striatus*), doesn't mind staying at the Aquarium seven years at a stretch. He not only keeps friendly with the other

NASSAU GROUPER *(Epinephelus striatus)*



RED GROUPER *(Epinephelus morio)*

boarders but perhaps entertains them with his continuous performance of changing from one color to another. The Nassau grouper is in fact a chameleon of the sea, being capa-

TIGER ROCKFISH *(Mycteroperca tigris)*

YELLOWTAIL *(Ocyurus chrysurus)*

ble of assuming eight distinct phases of coloration in as many minutes. From Florida throughout the West Indies it is everywhere an important market fish, often weighing as much as fifty pounds.

The Red Grouper (*Epinephelus morio*), which grows nearly as large as the Nassau grouper and lives as long in captivity, also has several different phases of color, but neither so many nor so striking. It is a valuable West Indies food fish.

There is nothing tigerish about the Tiger Rockfish (*Mycteroperca tigris*), but his stripes. Big—a twenty pounder—and handsome, he settles down amiably for a five-year stay with no apparent yearnings for his native West Indies.

The Soapfish (*Rhypticus bistrispinus*) derives its name from the soapy slime it throws off when placed in a small quantity of water. The scales are minute and so embedded in the skin that they are not apparent to the touch. Nothing is recorded as to its habits, but it easily endures captivity. The color is a warm brown, the body being dotted lightly with black and white and all fins tipped with dark blue.

RED SNAPPER *(Neomaenis aya)*

TRIPLE-TAILS—Lobotidae.

The Triple-tail (*Lobotes surinamensis*) of tropical waters, sometimes wanders almost to our doors, the Aquarium having specimens taken in summer in New York Bay. It is a large-sized food fish of thirty or forty pounds' weight. The backward projecting dorsal and anal fins suggest its common name.

CATALUFAS—Priacanthidae.

A wanderer from the tropics, the Redfish (*Pseudopriacanthus altus*), is probably the most brilliant fish visiting our shores. The largest recorded specimen is but eleven inches long, but what it lacks in size is compensated for in color, the whole fish being bright crimson with black-edged fins. Its other name, Big-eye, is equally appropriate, the very large golden eye being a most striking feature. Aquarium specimens from Long Island Sound and Atlantic City have lived sixteen months in captivity.

SNAPPERS—Lutianidae.

The Yellowtail (*Ocyurus chrysurus*) is only one of many fishes bearing that name. The Spanish name Rabirubia is frequently used. It is abundant about Key West, where fishermen sell many on the streets. The yellowish tint of

MUTTONFISH *(Neomaenis analis)*

the tail extends in a narrow band, forward to the eye. The Aquarium seldom lacks specimens of this handsome snapper.

The best known of the snappers is the Red Snapper (*Neomaenis aya*). It is easily distinguished from other species of snappers by its nearly uniform scarlet coloration.

GRAY SNAPPER *(Neomaenis griseus)*

SPOT SNAPPER *(Neomaenis synagris)*

It is the most important tropical fish that comes to United States markets. In 1903, thirteen million pounds were landed in ports of the Gulf states alone. The red snapper endures captivity well and is usually to be seen in the Aquarium.

A tropical snapper which occasionally wanders north in summer is the Muttonfish (*Neomaenis analis*). Florida anglers find it a gamy fish to catch. It reaches a weight of twenty pounds, and is highly valued in West Indian markets. Like most of the snappers in the Aquarium it lives well in captivity.

The Gray Snapper (*Neomaenis griseus*) is also called mangrove snapper from its habit of lingering among the roots of mangrove bushes, which grow in salt water. As a food fish it is one of the best of the snappers. The Dog Snapper (*Neomaenis jocu*), averages larger and has more color. The Spot Snapper (*Neomaenis synagris*) is recognizable by the dark blotch on the body, below the dorsal fin. It is one of the smaller species, usually of rosy coloration. The Schoolmaster (*Neomaenis apodus*) is more richly

SCHOOLMASTER *(Neomaenis apodus)*

colored than any of the others. All of these snappers are used for food some of them affording sport as game fishes. All are exhibited at the Aquarium, where they live many years.

BLUE-STRIPED GRUNT *(Haemulon sciurus)*

YELLOW GRUNT *(Haemulon flavolineatum)*
Dark phase (left), striped phase (right).

GRUNTERS—Haemulidae.

Several species of grunts from southern waters are usually to be found in the tanks, where they are easy to keep. As they move in schools and are easily netted, they are taken in abundance for tropical markets.

The hardy Blue-striped Grunt (*Haemulon sciurus*) is a steady and dependable exhibit. Handsome and lively, it is perpetually attractive. When two of these fishes play at pushing each other backward and forward like a pair of young goats, showing the bright red of their wide-open mouths, the game is captivating.

The Yellow Grunt (*Haemulon flavolineatum*) has interesting color changes, two of which are shown in the photograph. The change from one to another is instantaneous. Like most other grunts it is tropical in habitat, much used as food, and affords good sport to the angler.

The Tom Tate (*Bathystoma striatum*) is a small-sized but common food fish found from North Carolina to the West Indies. Like several other grunts, its mouth is bright red within. It is constantly nibbling at baits intended for larger fishes.

The Black Margate (*Anisotremus surinamensis*) is a fish

TOM TATE *(Bathystoma striatum)*

of both good size and quality, belonging to the Florida West Indies fauna. Length two or three feet.

The Pigfish (*Orthopristis chrysopterus*), found from New York to the Gulf of Mexico, but more abundant south-

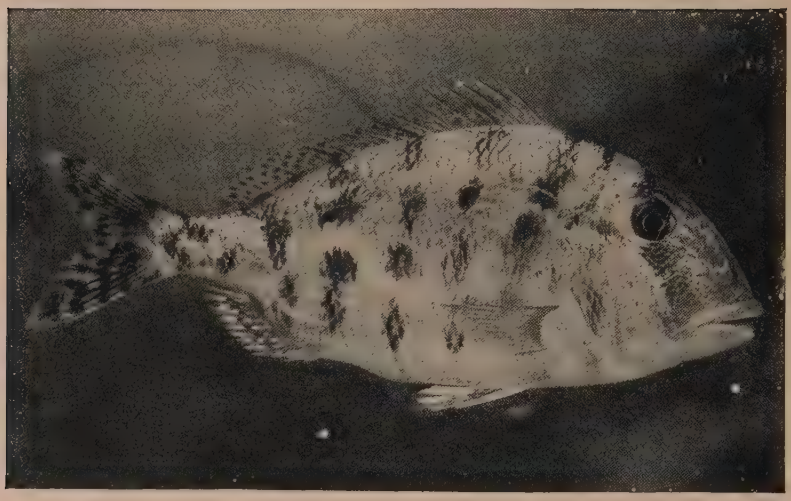
BLACK MARGATE *(Anisotremus surinamensis)*

PORKFISH *(Anisotremus virginicus)*

ward, is of small size, but a good food fish. It is common along sandy shores, and is well known for the grunting sounds it makes when captured.

A hardy species of which there are always many on exhi-

PINFISH *(Lagodon homboides)*



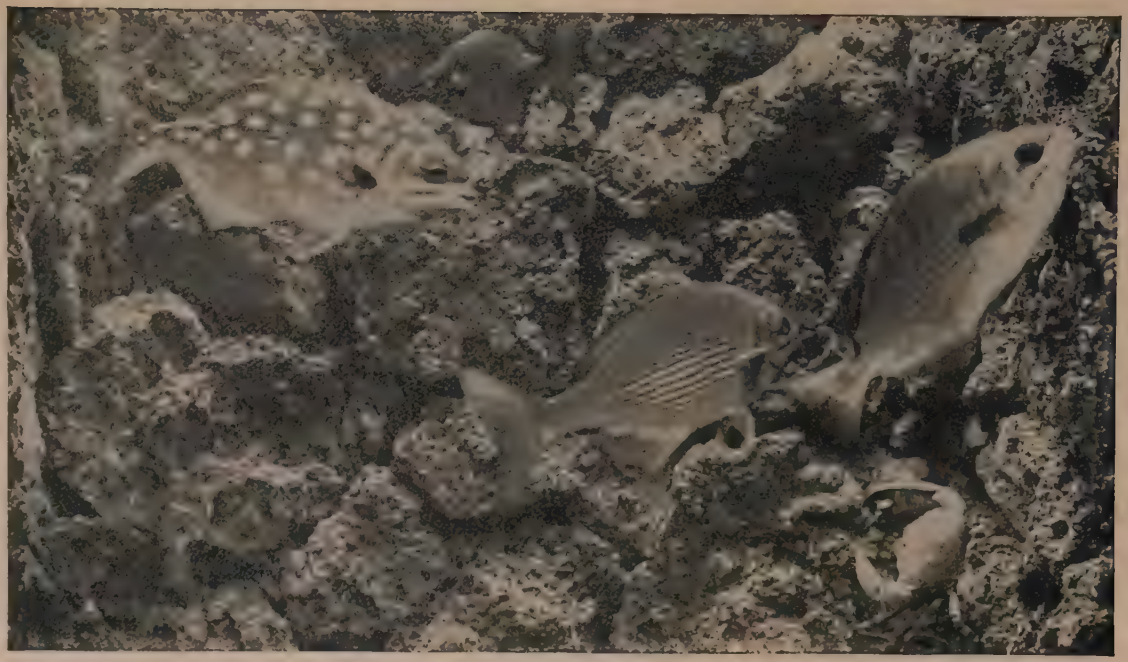
GRASS PORGY *(Calamus arctifrons)*

bition, is the Porkfish (*Anisotremus virginicus*), which belongs to the Florida and West Indies fauna. Yellowish in coloration, with striking black bands, it is very showy. It is an abundant and excellent food fish, less than a foot in length.

PORGIES—Sparidae.

The Pinfish (*Lagodon rhomboides*) distributed along our coast from New York to the Gulf of Mexico, is prized wherever found. It is not abundant in the north, but is quite important in the south. The much overworked name Sailor's Choice is one of several names applied to it. The fish may be recognized by the dark spot back of the eye and above the pectoral fin.

The Grass Porgy (*Calamus arctifrons*) is a small species found on grassy bottoms in Florida. Its rapid color changes vary from quite pale to profusely mottled and heavily cross-banded. Three other porgies have shared its quarters, the Little-head (*Calamus proridens*), the Saucer-eye (*Calamus calamus*), and the Jolt-head (*Calamus bajonado*). All are useful food species, taken with nets and hooks, and all thrive in captivity.



BERMUDA CHUB *(Kyphosus sectatrix)*

SHEEPSHEAD *(Archosargus probatocephalus)*

The Jolt-head Porgy (*Calamus bajonado*) is the largest of the porgies, weighing about eight pounds. It probably gets its name of jolt-head from the habit of knocking shell-fish from wharves and rocks with its jaws. It is an abundant and important food fish in Florida.

One of the best of food fishes is the Sheepshead (*Archosargus probatocephalus*), of the Atlantic and Gulf coasts, but not abundant in the latitude of New York. Large specimens weigh from fifteen to twenty pounds, and more than two million pounds are taken annually. It takes the hook and affords sport to anglers. It has been kept at the Aquarium for five years at a time.

The Scup or Porgy (*Stenotomus chrysops*) is a well known fish from Massachusetts to South Carolina. Seaside anglers take great numbers, using hand lines with shrimp and clam bait. Millions of pounds are caught for market. This fish is common in summer about Long Island.

RUDDER FISHES—Kyphosidae.

The widely distributed Bermuda Chub (*Kyphosus sectatrix*), found throughout the West Indies, visits New York waters in summer. It is called Rudder-fish sometimes from its habit of following vessels. A good food and game fish,

DRUMFISH *(Pogonias cromis)*

averaging three or four pounds, it is much sought by anglers in Florida waters. Like most fishes of tropical regions, it makes frequent changes of markings, at one moment showing numerous horizontal stripes, an instant later being densely spotted with white. These two phases are shown in the accompanying photograph.

CROAKERS—Sciaenidae.

The Spot (*Leiostomus xanthurus*) has about the same distribution as the pigfish, is good for food, and taken for market in considerable numbers. It is quite common in New York Bay in summer, where it is called Lafayette. It is said that this fish was remarkably abundant in our waters in Revolutionary times, and was named after General Lafayette The name spot is derived from the presence of a dark blotch at the base of the pectoral fin.

The Croaker (*Micropogon undulatus*), which makes a croaking or grunting noise, is a useful and abundant food fish of the Atlantic and Gulf Coasts, especially southward. It is of rather small size and is taken chiefly with hook and line.

A large and valuable commercial species, especially southward, is the Channel Bass (*Sciaenops ocellatus*), which

SERGEANT MAJOR *(Abudefduf saxatilis)*

reaches a length of five feet. It is also called Red-drum. This is the most important food fish of the Texas coast. It has been exhibited at the Aquarium, but is not abundant near New York.

The Drum (*Pogonias cromis*) is a large sized fish, sometimes weighing eighty pounds. It is well known for the drumming noise it makes. This species runs in large schools, and is very destructive to young oysters. The young are better for food than the large fish. It thrives in captivity and specimens have lived in the Aquarium several years.

About thirty million pounds of Weakfish (*Cynoscion regalis*) are taken during the year. This species, also called Squeteague in the north and Sea Trout in the south, enters tidal waters and is taken in great numbers for sport. Large quantities of the young are devoured by schools of bluefish. The name weakfish appears to have been derived from the softness of the mouth from which the hook readily tears away.

The Kingfish (*Menticirrhus saxatilis*), also called Whiting, has the same distribution as the croaker. It enters the mouths of rivers and goes forty miles up the Hudson.

HOGFISH *(Lachnolaimus maximus)*

It is a fish of most excellent flavor and great quantities are used for food. It is popular with sea fishermen and takes the bait readily.

A fish remarkable in form and in coloration is the Ribbonfish (*Eques lanceolatus*) of Florida and the West Indies. It is usually less than six inches in length. The arrangement of its three black bands instantly attracts attention: the first vertically across the head through the eye, the second obliquely from top of head to tip of ventral fin; the third from tip of dorsal spines to their base, then downward and backward to tip of tail. Specimens have lived in the Aquarium two years. The Bermuda name is Cubbyu.

DEMOISELLES—Pomacentridae.

Small but beautiful and active fishes are always to be seen about wharves and reefs in Florida and the West Indies. One of the commonest of these is the Sergeant Major (*Abudefduf saxatilis*). It is much given to camouflage, being at times either silvery or black, but oftenest yellowish with heavy bands of black, changing from one phase of

YOUNG TAUTOG *(Tautoga onitis)*

coloration to another almost instanly. It shows these changes in the tanks of the Aquarium, where it makes itself quite at home and lives for years.

A thoroughly naturalized citizen, the Beau Gregory (*Eupomacentrus leucostictus*), seems to enjoy every minute of life in the community of the tanks, where it lives long and prospers. A dozen of these are forever playing and chasing each other as they do in the sunlit rock pools of the tropics. The largest are usually not over four inches long.

The Golden-Tail (*Microspathodon chrysurus*) of Florida, Bermuda and the West Indies, is quite common, but is seldom seen, owing to the fact that it is timid and lives entirely in holes in the reefs. The young are more densely spotted with sky blue than the adults, and do not have the bright golden tail.

WRASSES—Labridae.

The Hogfish (*Lachnolaimus maximus*), a well known tropical food species, reaches a weight of twenty pounds. It is chiefly interesting in the tanks of the Aquarium on account of its changes in color, which take place with great

YOUNG CUNNER *(Tautogolabrus adspersus)*

frequency. At one moment the fish may be of a uniform reddish-brown color, and a moment later conspicuously mottled over its entire body.

A striking fish that deserves a better name is the Spanish Hogfish (*Harpe rufa*), which comes from Florida and the West Indies. Violet-red above and yellow-orange below, its handsome coloration may have suggested its other name, Lady-fish; but with a rather pig-like snout, the first name clings in spite of all efforts to be showy.

PUDDING WIFE *(Iridio radiatus)*

RAINBOW PARROT-FISH *(Pseudoscarus guacamaia)*

A fish well known to local anglers is the Blackfish or Tautog (*Tautoga onitis*), which is found along the Atlantic coast from Maine to South Carolina. It is a permanent resident in New York waters where half a million pounds are caught yearly. The greatest weight of the blackfish is about twenty-two pounds. It is hardy in captivity and specimens have lived in the Aquarium seven years.

The Cunner (*Tautogolabrus adspersus*), a near relative of the tautog, is a common species along the Atlantic coast as far south as New Jersey, and is abundant around Long Island all the year. It takes the hook readily and being found about wharves and bridges, great numbers are caught by anglers.

The Pudding-wife (*Iridio radiatus*) is the largest of its genus, being sometimes eighteen inches in length. Specimens have lived eight years at the Aquarium. There is considerable difference between the adult male and female in this species, the former being largely olive, with the lower parts bluish-green, while the latter is bronze-olive, with the under parts pearly blue. The superficial differences between the sexes in fishes are usually not very noticeable. Florida and West Indies fauna.

RED PARROT-FISH *(Sparisoma abildgaardi)*

One of the smallest of the *Iridios* is the Slippery Dick (*Iridio bivittatus*), usually less than six inches long. Florida and West Indies, abundant about the reefs.

The most striking in coloration of all the wrasses is the Bluehead (*Thalassoma bifasciatus*). The head is deep blue, the posterior half of the body green, sometimes taking on a yellow tinge. A slim but active little fish, it paddles its way about the tank with the pectoral fins only. It inhabits the reefs of Florida, Bermuda, Bahamas and West Indies.

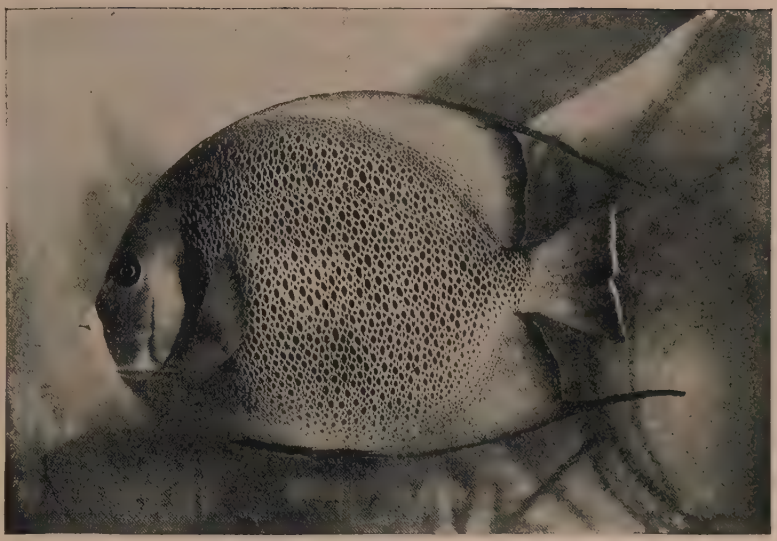
PARROT-FISHES—Scaridae.

Several species of parrot-fishes are brought to the Aquarium. These fishes are so named from the character of their teeth, which are united in a solid mass in each jaw, forming a parrot-like beak. In large specimens, the so-called beak is very strong, having power to bite through a small fish hook. The largest of the parrot fishes is the Rainbow Parrot (*Pseudoscarus guacamaia*), which reaches a length of three feet. Its beak, which projects beyond the fleshy lips, is a bright blue. One of the most brilliant members of the family is the Blue Parrot (*Scarus caeruleus*), which has a uniformly turquoise-blue coloration. The Red Parrot (*Sparisoma abildgaardi*), and the Green Parrot (*Sparisoma viride*) are also brilliantly colored. The parrot-fishes

SPADEFISH *(Chaetodipterus faber)* Photo by Dr. E. Bade

are common in the West Indies region. Those brought to the Aquarium are usually obtained in Florida or the Bermudas. Like other tropical fishes, they are capable of mak-

BLUE ANGEL-FISH *(Angelichthys isabelita)*



BLACK ANGEL-FISH *(Pomacanthus arcuatus)*

FRENCH ANGEL-FISH *(Pomacanthus paru)*

FOUR-EYES *(Chaetodon capistratus)*

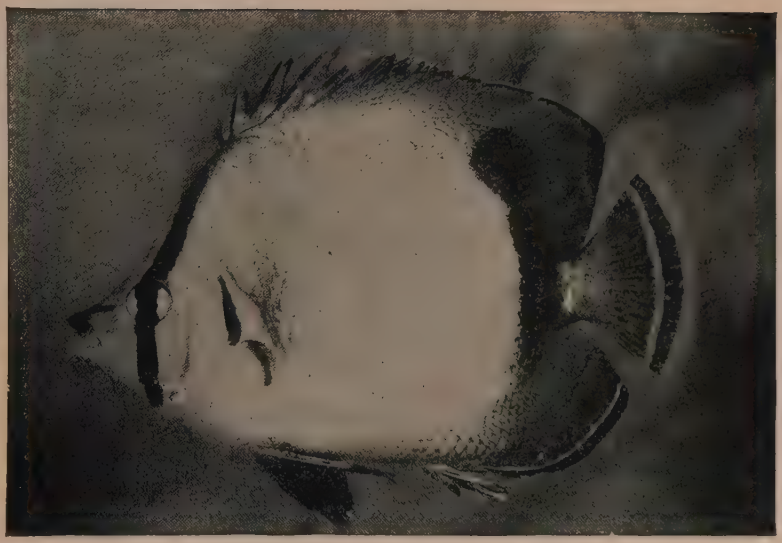
ing remarkable, instantaneous changes in color. Among the West India islands they are used for food to some extent, but in Florida waters are but little valued.

SPADEFISHES—Ephippidae.

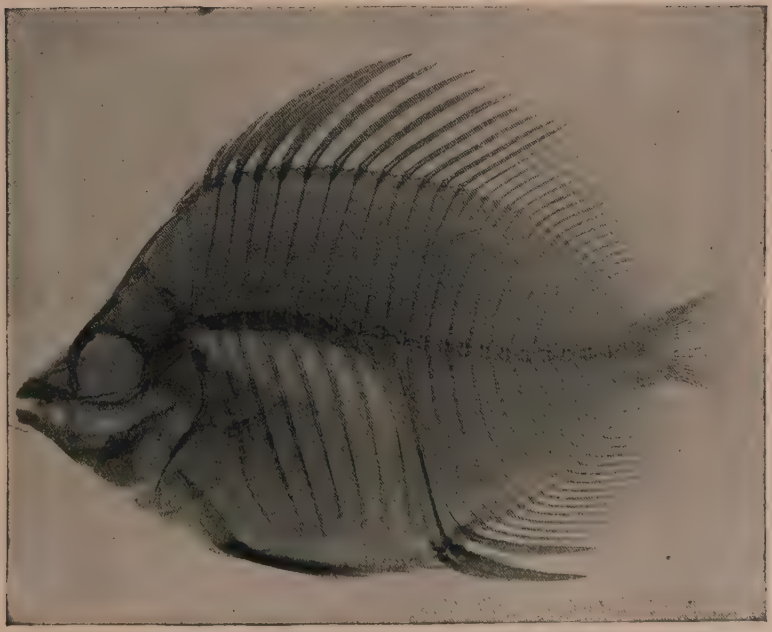
The Spadefish (*Chaetodipterus faber*) is a tropical species reaching the latitude of New York in summer. It is highly esteemed for food and reaches a weight of twenty pounds. Its favorite food at Trinidad is the Portuguese man-of-war (*Physalia*), and fishermen take it with *Physalia* for bait. The spadefish is much compressed laterally and is conspicuously marked with vertical black bands. It is a hardy species in captivity. It can change color instantly from white to black or to the banded phase shown here.

ANGEL AND BUTTERFLY FISHES—Chaetodontidae.

One of the most beautiful and graceful inhabitants of the coral reefs of the West Indies is the Blue Angel-fish (*Angelichthys isabelita*), which is common in Florida and the Bermudas. Other species of angel-fishes are the Queen Angel-fish (*Angelichthys ciliaris*), Yellow-tailed Angel-fish (*Angelichthys townsendi*), Black Angel-fish (*Pomacanthus arcuatus*), and French Angel-fish (*Pomacanthus paru*). All



BUTTERFLY-FISH *(Chaetodon ocellatus)*



Radiograph of Butterfly-Fish by Dr. H. G. Piffard

DOCTOR FISH *(Teuthis hepatus)*

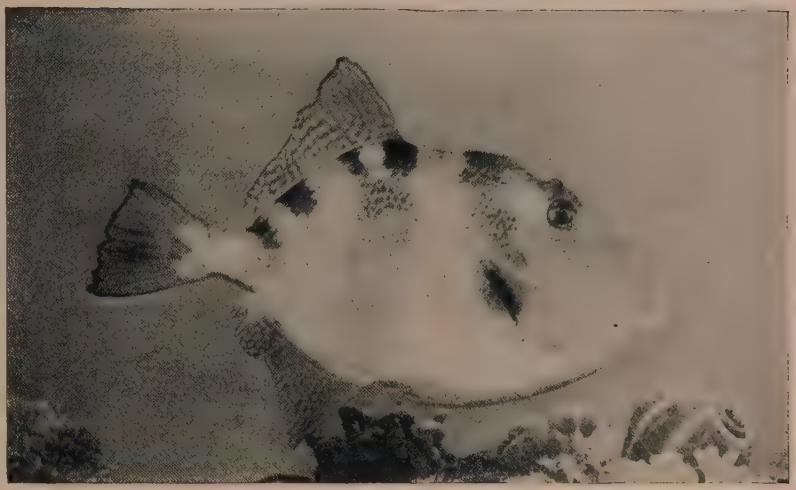
of these thrive in the Aquarium and the visitor will find them well worth observing.

Nothing more charming among the smaller sea fishes can be found than the Four-eyes (*Chaetodon capistratus*), which inhabits the coral reefs of the entire West Indies region. Its name is appropriate, the large, white-ringed black spot near the tail being easily mistaken for the real eye when the fish is viewed not too closely. The eye is not only small but rather obscured by the dark line extending vertically across the head. The Four-eyes is brightly colored, active and decidedly pugnacious. It may often be seen picking minute crustaceans from other fishes.

The Butterfly (*Chaetodon ocellatus*) is of similar appearance, but larger, while the eye-like spot is placed higher up and lacks the white ring. It has the same wide West Indian range, but wanders northward in summer to Long Island. A dozen butterflies may often be seen in the same tank.

SURGEONFISHES—Teuthididae.

The Blue Surgeon (*Teuthis cæruleus*), also called Blue



LEATHER JACKET *(Balistes carolinensis)*

Tang, receives its name from the sharp erectile spine or lancet which occupies a socket on each side of the tail. It can inflict serious wounds with its lancet and requires careful handling by the fisherman. Another species usually kept with it and similarly provided with a cutting lancet, is the Doctor Fish (*Teuthis hepatus*).

TRIGGERFISHES—Balistidae.

Trigger fishes are so called because the second dorsal spine can be made to lock the first and hold it rigid. The Leather Jacket (*Balistes carolinensis*) is one of these. It is taken for the Aquarium from local waters in summer, but is more abundant southward.

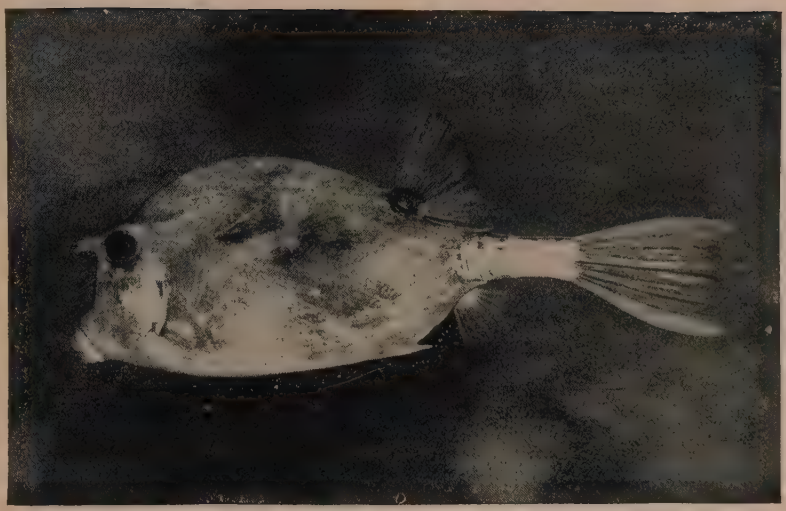
The Queen Trigger-fish (*Balistes vetula*), of Florida and the West Indies, attracts instant attention on account of the brilliant blue markings on its head.

The Ocean Turbot (*Canthidermis maculatus*) is the largest of the triggerfishes to be seen in our collections. It has the habit of swimming on its side at the surface, like the ocean sunfish (*Mola mola*). Tropical; mostly in the open ocean.

FILEFISHES—Monacanthidae.

Two species of file fishes enter New York Bay in summer:

QUEEN TRIGGERFISH (upper) and TRUNKFISH



COWFISH *(Lactophrys tricornis)*

the common Filefish (*Monacanthus hispidus*), and the Orange Filefish (*Aleutera schoepfii*). The conspicuous dorsal spine in these fishes is armed with file-like barbs. The slow-moving orange filefish has the curious habit of swimming in an oblique position with head downward. The young are quite different in appearance from the adults, having oblique, broad black bands, while the adults lack the bands and are conspicuously yellow. All kinds of file fishes have rough and leathery skins.

TRUNKFISHES—Ostraciidae.

The Trunk-fish (*Lactophrys triqueter*), Buffalo Trunkfish (*Lactophrys trigonus*) and Cowfish (*Lactophrys tricornis*), might properly be called tortoises of the sea as they are similarly encased in hard shells. The Cowfish is so called from the conspicuous spines or horns which project forward from the top of the head. These fishes are remarkably hardy, and will live for two or three hours out of water. They have the habit in captivity of projecting the head above the surface and squirting water a few inches into the air.

PUFFERS—Tetraodontidae.

Fishes of especial interest are the puffers or swell fishes.

PUFFER *(Spheroides maculatus)*

Two of these, the Common Puffer (*Spheroides maculatus*) and the much larger Smooth Puffer (*Lagocephalus laevigatus*), are found in New York Bay in summer. All puffers have power to inflate themselves with air and float

PUFFER DISTENDED WITH WATER

Photo by C. H. Townsend

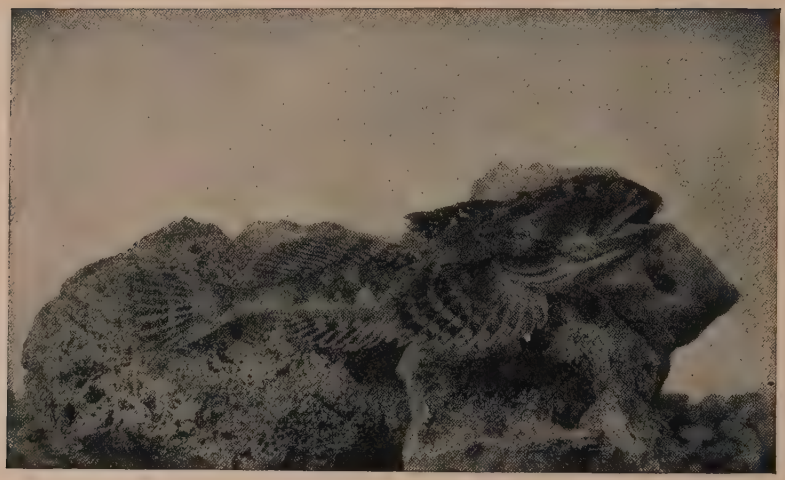
OCEAN SUNFISH *(Mola mola)*

on the surface of the water. This is a protection against their enemies. They can also inflate themselves with water and have been observed to do so in aquarium tanks when attacked by larger fishes. When taken from the water in nets they inflate quickly and become almost globular. The air being retained by a valve in the throat, they can be tossed about in this condition for a time without discharging it in the least.

The Southern Puffer (*Spheroides spengleri*) which is usually less than a foot in length, is often kept with our northern species.

PORCUPINE FISHES—Diodontidae.

The Spiny Boxfish (*Chilomycterus schoepfii*) has almost the same capacity of inflation as the puffer. It has the additional defense of numerous spines which become erect as the body inflates, making it a decidedly uncomfortable mouthful to any fish so unwise as to attempt to seize it. This fish, also called Porcupine, is abundant along our coast in summer.



LONG SPINED SCULPIN *(Myoxocephalus octodecimspinosus)*

The Porcupine-fish (*Diodon hystrix*) is the largest of the Atlantic species having the power of inflation, reaching a length of three feet. It is densely covered with sharp spines, which become erect when the body is tightly filled with air. The dried and inflated skin of this fish is a common object in the shops of curio dealers in the tropics.

HEAD FISHES—Molidae.

The Ocean Sunfish (*Mola mola*) is one of the world's most remarkable fishes, as well as one of the largest, being known to reach a weight of eighteen hundred pounds. An unusually small specimen, weighing one hundred and sixty-five pounds, was brought to the Aquarium, where it lived only a short time, owing to injuries received during transportation. The ocean sunfish inhabits the warmer parts of the Atlantic and Pacific oceans, wandering northward in summer. It occurs off the New Jersey and Long Island shores nearly every summer. It is a sluggish creature, and when basking at the surface is quite indifferent to the presence of man. Fishermen often prod it with their oars without greatly disturbing it.

SCULPINS—Cottidae.

Sculpins of several kinds are brought to the Aquarium,

SEA RAVEN *(Hemitripterus americanus)*

the commonest of which is the Long-spined Sculpin (*Myoxocephalus octodecimspinosus*). These fishes are edible but are mostly used for bait.

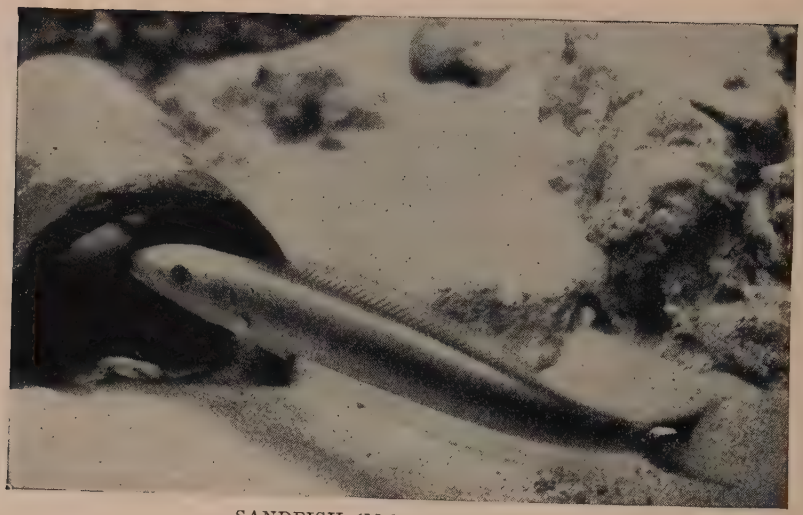
A large sized sculpin, sometimes two feet in length, is the Sea Raven (*Hemitripterus americanus*). It is subject to great variation in color, ranging from bright yellow to dark red. It is not often eaten, although the flesh is excellent.

LUMP SUCKERS—Cyclopteridae.

The appearance of the Lump Sucker (*Cyclopterus lumpus*) naturally suggests its name, being short and thick of body, fleshy and without scales, and provided with a sucking disk with which it adheres to rocks. It is a northern fish, sometimes taken on the New York coast, and has been exhibited at the Aquarium.

BLANQUILLOS—Malacanthidae.

An inhabitant of sandy and grassy bottoms, the Sandfish (*Malacanthus plumieri*), makes conspicuous tunnels through patches of eel-grass in which it lies with its head

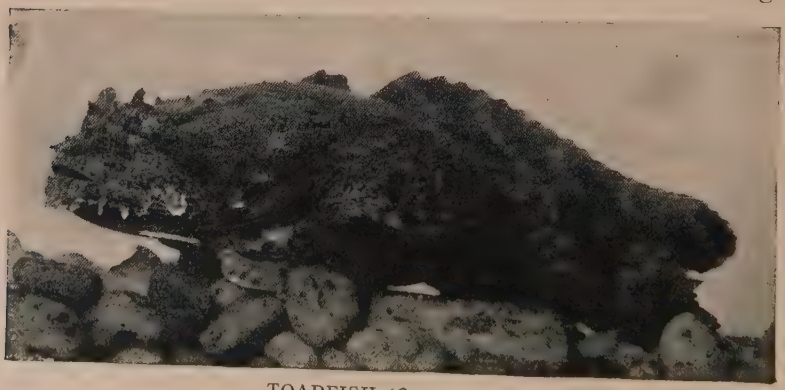


SANDFISH *(Malacanthus plumieri)*

protruding. In the Aquarium, where the sandfish has lived for several years, it has cheerfully accepted a section of terra-cotta pipe in lieu of its favorite grassy tunnel. This fish comes from Florida and Bermuda, and is one of the few fishes with blue eyes.

STAR GAZERS—Uranoscopidae.

The Stargazer (*Astroscopus guttatus*) somewhat resembling a sculpin in appearance, is well named, as its eyes look directly upward from its flat-topped head. It belongs



TOADFISH *(Opsanus tau)*

EEL-POUT *(Zoarces anguillaris)*

to the middle Atlantic coast region and is found in New York Bay.

TOADFISHES—Batrachoididae.

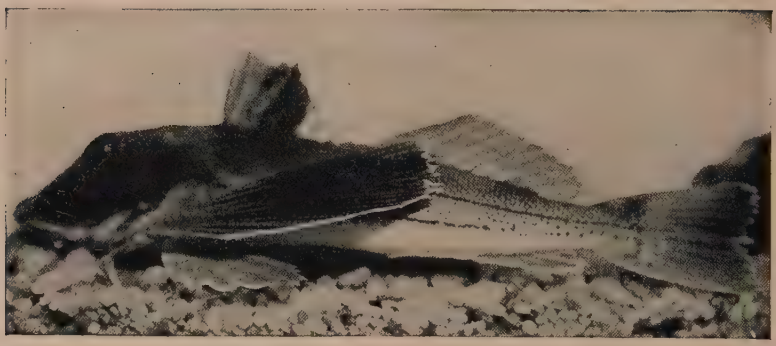
The grotesque Toadfish (*Opsanus tau*) is found in all our bays from Massachusetts, southward. Large specimens may be over a foot in length. It deposits its egg masses in empty shells, on pieces of sunken boards, or in tin cans, to all of which the eggs adhere, and the nest is guarded by the parent fish. It is a hardy creature and will live for hours out of the water.

EEL-POUTS—Zoarcidae.

The Mutton Fish or Eel Pout (*Zoarces anguillaris*) also called Ling, is kept in the Aquarium only during the colder months. It is almost eel-like in shape, and sometimes a yard long. It is often caught in large numbers in the vicinity of New York. The mutton fish is found from Delaware northward.

GURNARDS—Triglidae.

A most interesting fish is the Red-winged Sea Robin (*Prionotus strigatus*) which, from the great size of its



RED-WINGED SEA ROBIN *(Prionotus strigatus)*

pectoral fins might pass for a flying fish. It is a very attractive species in the Aquarium often spreading its broad, showy wings. Sea robins are frequently taken in large numbers in the stationary pound nets along the coast and are common in New York Bay in summer. They are found in shallow water and have the habit of burying in the sand for concealment. These fishes are edible but not often used for food. A smaller species (*Prionotus carolinus*) is also found in New York waters.

FLYING GURNARDS—Cephalacanthidae.

Flying Gurnard (*Cephalacanthus volitans*). This fish, with pectoral fins larger than the sea robin, is found on both sides of the Atlantic Ocean, but is rare as far north as New York. It can sail in the air like the flying fishes but only for very short distances.

REMORAS—Echeneididae.

The Shark Sucker (*Echeneis naucrates*) also called Sucking-fish, attracts the attention of visitors to the Aquarium by clinging to the glass front, or the walls of its tank, by means of the peculiar sucking disc on the top of the head. It is the habit of the sucking-fish to attach itself to sharks, turtles, porpoises, and even whales and ships. This habit has been followed so long that the fish has lost all capacity for an independent career. The powerful sucking disc has been developed at the expense of its independence, so that it has to be towed through the seas by creatures which cannot shake it off. This fish is met with in all warm seas, and

SHARK SUCKER *(Echeneis naucrates)*

is found as far north in summer as Cape Cod. It is often brought into New York Bay by sharks. When placed in a pail of water, it instantly attaches itself to the vessel, from which it can only be dislodged with difficulty. When lifted by the tail under such conditions, its suction hold is sufficiently strong to raise both bucket and water from the ground. Two specimens were tested in the New York Aquarium, one lifting a pail with water weighing twenty-one pounds, the other twenty-four pounds. They might, indeed, have lifted even greater weights. Natives of Africa and other countries have, by tying a cord to the tail of this fish, employed it in the catching of fish and turtles.

CODFISHES—Gadidae.

The Codfish (*Gadus callarias*) is one of the most important food fishes in the world. Many millions of pounds are caught yearly by United States vessels, and still greater quantities are taken in Europe and Canada. It has been known to reach a weight of one hundred pounds and a length of six feet. On the Atlantic coast it ranges south as far as Virginia. The cod fishery of Alaska has developed into an important industry. Few fishes are more prolific than the cod. A seventy-five pound specimen may produce as many

SPOTTED CODLING *(Phycis regius)*

as nine millions of eggs. The shore cod fishery of the New England coast, threatened with exhaustion from over-fishing many years ago, has been re-established through the agency of government hatcheries.

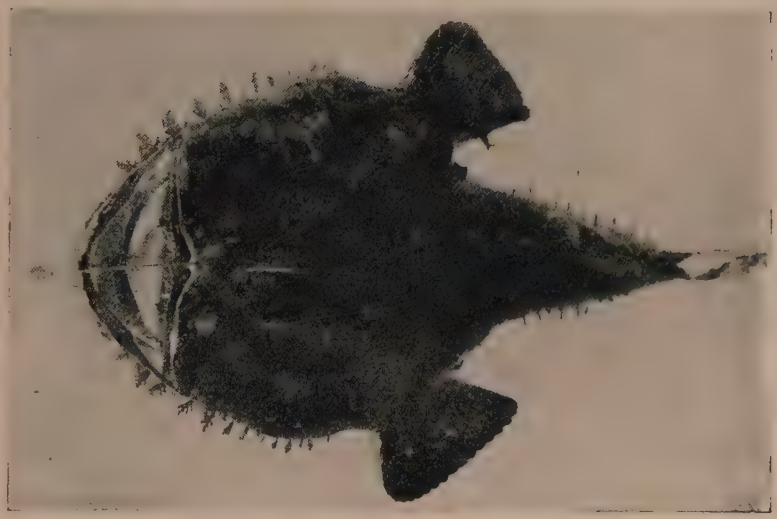
Other fishes of the cod family often to be seen in the Aquarium are the Pollack (*Pollachius virens*), Tomcod (*Microgadus tomcod*), White Hake (*Urophycis tenuis*), and Squirrel Hake (*Urophycis chuss*). All of these are valuable food fishes, which equal the cod in edible qualities.

The Haddock (*Melanogrammus aeglefinus*), like the cod, is found on both sides of the Atlantic and belongs to the same family. It is taken in great quantities in the same way.

The only striking fish of the cod family is the Spotted Codling (*Phycis regius*), which has the heavily marked lateral line broken by fourteen conspicuous white spots. Prof. Agassiz observed electrical powers in this fish. It is rather rare in New York waters and has been taken from the shore out to a depth of one hundred and sixty-seven fathoms.

FLOUNDERS—Pleuronectidae.

The largest and best known flounder of the Atlantic coast



ANGLER *(Lophius piscatorius)*

is the Summer Flounder (*Paralichthys dentatus*). It is known as fluke in New York waters, where large numbers are taken by anglers as well as by commercial fishermen. It is abundant in summer, but disappears in winter.

Probably the best flounder of our markets is the Winter Flounder (*Pseudopleuronectes americanus*), which is common around Long Island and extends along the Atlantic coast from Labrador to North Carolina. It is a large species and important numbers are propagated artificially by the Government. All flounders, from the great halibut down, are edible. Fishes of the flounder family are recognizable at once, as they have both eyes on the same side of the body. When very young, the eyes are on opposite sides of the head.

Other species to be found in the Aquarium from time to time are the Four-spotted Flounder (*Paralichthys oblongus*), and Star Flounder (*Lophopsetta maculata*).

ANGLERS—Lophiidae.

The Angler (*Lophius piscatorius*), variously named Goosefish, Bellows-fish and Fishing-frog, is common along our shores. It is a voracious fish, with a very large mouth and specimens have been caught containing several wild ducks. Lying on the bottom and partly hidden in the sand, it lures

A HAPPY FAMILY OF TROPICAL FISHES
(*Twenty Species*)

GIANT SNAPPING TURTLES FROM THE LOWER MISSISSIPPI

other fishes by a waving spine on top of the head. The angler lays its eggs in a mucous band nearly thirty feet long.

FROG-FISHES—Antennariidae.

The little toad-like Sargasso Fish (*Pterophryne histrio*), which inhabits the floating weed of the Gulf Stream, is sometimes drifted near the New York coast and has been brought to the Aquarium. It is always colored like the brownish weed masses in which it lives.

TURTLES—*Chelonia*

Some of the larger fresh-water turtles regularly taken for the market are called "sliders." One of these is the Red-Bellied Turtle (*Chrysemys rubriventris*) of the eastern states but not found north of New Jersey. It is easily recognized by the red color of the under shell, and grows to be about sixteen inches in length.

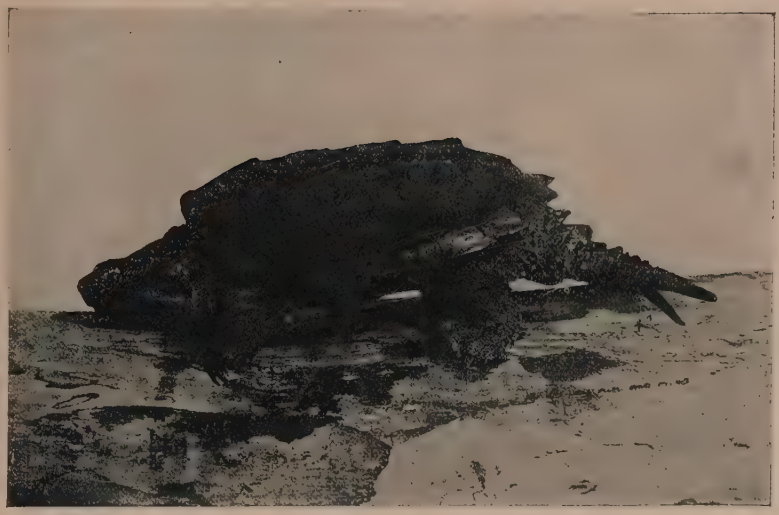
The Cumberland Turtle (*Chrysemys elegans*) is the principal "slider" of the markets, and is found in the Middle States from Ohio to the Gulf coast. It may be recognized by the red blotch on the side of the head.

The Yellow-bellied Slider (*Chrysemys scabra*), found from Virginia to Georgia has a yellow patch behind the eye which serves to identify it.

A number of other species of fresh-water turtles are brought to the Aquarium from the south and west.

The Mud Turtle (*Cinosternum pennsylvanicum*) is of the same size and has about the same distribution as the musk turtle. Unlike some of the other pond turtles which winter in the mud at the bottom of ponds, this species is believed to winter in dry ground. All turtles lay their eggs in small holes, which they excavate in earth or sand, and the young are left to shift for themselves.

The widely distributed Snapping Turtle (*Chelydra serpentina*) is the largest species of the northern states and Canada, sometimes weighing as much as sixty pounds. It is a well known turtle, much used for food, and not uncommonly found in the markets. The snapping turtle is decidedly carnivorous and is voracious and dangerous to handle. It lays round eggs, whereas most native turtles lay eggs of oval form.



SNAPPING TURTLE *(Chelydra serpentina)*

Largest of United States fresh-water turtles is the Alligator Snapping Turtle (*Macrochelys lacertina*) of the lower Mississippi and rivers of the Gulf States. The Aquarium has had specimens weighing one hundred pounds, and it is known to reach a weight of about one hundred and forty pounds. It is fully as vicious as the northern snapping turtle, and has jaws powerful enough to break off an ordinary broom handle. It is used for food, and is often sold in southern markets.

A species rather common in the northern states from Massachusetts to Wisconsin is Blanding's Turtle (*Emys blandingi*), which has the feet partly webbed, but lives rather more on land than in the water. The lower shell is hinged somewhat like that of the box tortoise, partly enclosing the head and legs. The upper shell of this species is about eight inches long. It spends much time on land searching for berries and other food not obtainable in the water.

The Map Turtle (*Malacoclemmys geographica*), having about the same distribution as the Blanding Turtle, is so called from the numerous yellow lines which cover the top

BLANDING'S TURTLE *(Emys blandingii)*

SOFT-SHELLED TURTLE *(Trionyx spinifer)*

WOOD TURTLE *(Chelopus insculptus)*

shell. It reaches a length of ten inches and is often used for food. The jaws of this species are rather heavy, and it feeds largely on fresh-water mollusks.

In some of our native turtles the shell is soft and flexible and the neck decidedly long. The Soft-shelled Turtle (*Trionyx spinifer*), also called Leather-back, is usually to be seen in the Aquarium, and is found throughout the northern states. The length of its upper shell is sometimes fourteen inches, and the species is much used for food. The soft-shelled turtle has very sharp jaws and is a dangerous biter. It lives well in captivity when sand is placed in the bottom of its tank in which it can hide and cleanse itself.

A much larger species which comes from the Gulf Coast region is the Southern Soft-shelled Turtle (*Trionyx ferox*). The Aquarium has specimens with the top shell eighteen inches long. It is often sold in the markets for food. Soft-shelled turtles like muddy bottom and seldom leave the water except to deposit their eggs. They are all very active and predaceous.

The Wood Turtle *(Chelopus insculptus)*, which lives

BOX TORTOISE (*Terrapene carolina*)

more on land than in the water, belongs in the northeastern states from Maine to Ohio. Its top shell measures about eight inches. The fleshy parts of the turtle are brick red. It feeds largely on vegetable matter and winters in dry earth under leaf mould.

The Box Tortoise (*Terrapene carolina*) is not an aquatic species and properly does not belong among the exhibits of the Aquarium, although it is often received there. It is widely distributed throughout the eastern and middle states. It is a strictly land species, wintering and laying its eggs in dry ground. It is quite variable in coloration, feeds largely on toadstools and other plant life, and is a useful destroyer of insect pests. In the box tortoise the lower shell is hinged, affording complete protection to the head and legs when they are drawn in.

The Diamond-back Terrapin (*Malaclemmys centrata concentrica*) is an inhabitant of the salt marshes from Massachusetts to Texas. This is the epicure's turtle, and is by far our most valuable species. It is yearly becoming scarcer

TEXAS DIAMOND-BACKED TERRAPIN *Malaclemys pileata littoralis*
Albino specimen from Texas.

and higher priced. Attempts are now being made to increase the supply by collecting and raising the young. There is a remarkable difference in size between the males and females. The former are always of small size, while the latter may reach nine inches in length. Large-sized diamond-backs are now worth several dollars apiece.

The most abundant pond turtle of the eastern states is the Painted Turtle (*Chrysemys picta*), which is found all the way from Canada to the Gulf of Mexico. It is easily identified by the crimson markings around the edge of the upper shell. It is always a rather small species, the top shell seldom exceeding six inches in length. It eats both vegetable and animal food.

The Spotted Turtle (*Chelopus guttatus*), of the north-eastern states from Maine to Indiana, may be known by the small, bright yellow spots on top of the shell. Although found in ponds and small streams everywhere, it is never so abundant as the painted turtle, and is always of small size. It feeds largely on aquatic insects.

SPOTTED TURTLE *(Chelopus guttatus)*

MUHLENBERG'S TURTLE *(Chelopus muhlenbergii)*

MATAMATA TURTLE *(Chelys fimbriata)*

Muhlenberg's Turtle (*Chelopus muhlenbergii*) is our rarest species, being apparently restricted to southern New York, northern New Jersey and eastern Pennsylvania. It is sometimes found near New York City. This is one of the very small turtles, seldom exceeding three and a half inches in length. It may be recognized by the bright orange spot on the side of the head. It is a species which often leaves the water.

Another very small species is named from the musky odor which it gives off when handled. The Musk Turtle (*Aromochelys odoratus*) is thoroughly aquatic, seldom leaving the water. This little turtle is widely distributed in the eastern United States and the young are the hardiest of all small turtles in captivity. Like the large snapping turtle, it is a vicious biter.

Matamata or Bearded Turtle (*Chelys fimbriata*). There is no rougher-shelled turtle than the Matamata, whose top shell, with its heavy ridges, is suggestive of a relief map. It has no near turtle relatives and occupies a genus by itself. It reaches a large size and inhabits the tropical rivers of Brazil and the Guianas. The Matamata is one of the numerous species of tropical turtles, whose neck is folded

HAWKSBILL TURTLE *(Eretmochelys imbricata)*

sideways when withdrawn under the shell. The head and neck when extended are longer than the top shell.

Largest of all fresh-water turtles is *Podocnemis expansa* of the Amazon River whose upper shell reaches a length of three feet. The Aquarium has had specimens nearly two feet long. It is an important article of food to the natives, who also dig its eggs from the sand banks, literally by the million.

Handsomest of the sea turtles is the Hawksbill or Tortoise-shell (*Eretmochelys imbricata*) of the tropical seas. Specimens from Florida or the Bermudas are usually to be seen in the Aquarium. This is the species which yields the valuable tortoise shell of commerce, and it has been much persecuted in consequence. It is named hawksbill from the shape of its beak. The hawksbill grows very large and specimens have been found in which the top shell had a length of three feet.

The Green Turtle (*Chelonia mydas*), highly valued as a food species, is the most important of the sea turtles, about $50,000 worth being taken yearly in our southern states. Live green turtles are always to be seen in the turtle pool and a cast of a specimen weighing seven hundred pounds.

ATLANTIC GREEN TURTLE (*Chelonia mydas*)

that died in the Aquarium, may now be seen on the wall. This turtle was the largest ever taken by the dealers at Key West, Florida, where it was captured. In summer the green

LEATHERBACK TURTLE *(Sphargis coriacea)*

ALLIGATOR *(Alligator mississippiensis)*

turtle often wanders north to the latitude of New York. It feeds largely on sea weeds. It is remarkably hardy and lives many years in captivity.

A Pacific Green Turtle (*Chelonia virgata*), brought to the Aquarium in 1900, when almost small enough to put in one's hat, lived here for fifteen years.

The Loggerhead Turtle (*Thalassochelys caretta*) is believed to grow even larger than the green turtle. The flesh of the young is, however, more often used for food than that of the adults. The loggerhead visits the adjacent coast in summer.

The largest of all marine turtles is the Leatherback or Trunk Turtle (*Sphargis coriacea*). A cast from a specimen weighing eight hundred and forty pounds, which died in the Aquarium, is on exhibition here. The leatherback is an inhabitant of tropical seas, wandering north every summer to the latitude of New York. The fore flippers of this turtle are proportionately much longer than in any other species. All sea turtles lay their eggs in dry sand above tide mark. Their eggs are unfortunately so much used for food that the abundance of sea turtles is greatly reduced in consequence. None of the sea turtles ever leave the water except the females, which come ashore only to deposit their eggs.

AMERICAN CROCODILE *(Crocodilus americanus)*

CROCODILES AND ALLIGATORS—*Crocodilia*

In the crocodile pool will be found the Alligator (*Alligator mississippiensis*) of our South Atlantic and Gulf States. The largest specimen, now eleven feet long, has been in the building thirteen years and has grown very little during that period. The young grow rapidly when kept in warm water. In a tank with the water temperature at eighty degrees, they will grow five feet long in as many years. The alligator is now being exterminated for its valuable leather, and it is to be regretted that thousands of young alligators are brought north yearly by tourists, only to perish in the winter time, as they are seldom cared for properly.

A specimen of the American Crocodile (*Crocodilus americanus*), taken in southern Florida, has lived in the Aquarium many years. This genus is easily distinguishable from the alligator by its narrow head and rather pointed snout, the snout of the alligator being very broad. The eggs of the crocodile, like those of the alligator, are deposited in mounds of grass and decayed vegetation, and after hatching the young shift for themselves.

Photo by L. B. Spencer

BULL FROG *(Rana catesbiana)*

SERPENTS—*Ophidia*

Aside from the Common Water Snake (*Tropidonotus fasciatus*), the Aquarium has not yet attempted to keep aquatic serpents, provision for which will be made later. This species feeds chiefly on fishes, frogs and toads. Its greatest length is about four feet, but the average is less. The species is found everywhere throughout the eastern and middle states. The water snake brings forth its young alive, about forty in all. It bites quickly and has sharp teeth, but is not poisonous.

FROGS—*Anura*

Frogs of many kinds are brought to the Aquarium, but the building is not well suited for the keeping of such creatures and no serious attempt has been made to maintain a representative display of them. All of the larger frogs are valuable for food, and in some states great numbers are marketed. Frogs hide in the mud below the frost line in winter, and although possessed of lungs, cease breathing entirely. In the tadpole stage they are gill-breathers like the fishes. Frogs

LEOPARD FROG *(Rana pipiens)*

can change color to a considerable extent, becoming green, brown or gray at will. They shed their skins three or four times a year, working them off like a glove and generally eating the skins.

The largest of the frogs is the Bull Frog (*Rana catesbiana*), sometimes measuring seventeen inches from snout to toes of hind legs. It is highly valued as food, and great quantities are used. The bull frog is found in all states east of the Rocky Mountains. It is a voracious creature, eating any living thing it can capture, and is capable of leaping about seven feet. The tadpoles of this species do not often develop legs until they are over a year old.

The Green Frog (*Rana clamata*) is also called Screaming Frog, from a noise which it makes at times. It is next to the bull frog in size, and is easily known by a ridge on each side of the back. The male has a yellow throat and large ear discs.

The Leopard Frog (*Rana pipiens*) is found all over North America east of the Sierra Nevadas. It is distinguished from the pickerel frog, which it resembles, in having

HELLBENDER (*Cryptobrauchus alleghaniensis*)

the spots on the back more rounded. The male has an external vocal sac. It has the habit of wandering considerable distances from water and is a useful destroyer of insects. Large numbers of the young are sold to anglers for bait.

The Pickerel Frog (*Rana palustris*) may be known by the decided squareness of the spots on its back and by its ear disc, which is smaller than the eye. It has two ridges on each side of the back. This frog is found all over eastern North America.

The Wood Frog (*Rana sylvatica*) may be recognized by the conspicuous black ear patches. It is aquatic only in the spring, when its eggs are laid. In summer it lives in woods and becomes silent. The wood frog can take the longest leaps of any native species. It is widely distributed over the Eastern and Middle States.

SALAMANDERS—*Urodela*

The largest of all salamanders is the Giant Salamander (*Cryptobranchus maximus*), which inhabits cold mountain streams in Japan and China. It reaches a length of five feet. The specimens now in the Aquarium were received in 1913. A specimen taken to Europe by von Siebold,

MUD PUPPY *(Necturus maculosus)*

its discoverer, lived fifty-two years in captivity. It is taken with baited hook and is used for food.

An allied species called the Hellbender or Water Dog (*Cryptobranchus alleghaniensis*) is found from western New York and the Great Lakes, southward. It is our largest native salamander and sometimes exceeds twenty inches in length. It feeds largely on crayfishes, but is omnivorous, taking any of the small aquatic forms of life. It bites viciously, but is not poisonous.

The Mud Puppy (*Necturus maculosus*), also called Water Dog, belongs to the Mississippi River system, tributaries of the Great Lakes, the upper Hudson River and Lake Champlain. It has red external gills which persist throughout life and is entirely aquatic. It is brownish in coloration, with numerous dark spots on the back. The Aquarium has specimens exceeding thirteen inches in length and it is said to grow larger

The most interesting salamander and a comparatively recent discovery is the Texas Blind Salamander (*Typhlomolge rathbuni*), which comes from subterranean waters

TEXAS BLIND SALAMANDER *(Typhlomolge rathbuni)*

through the artesian well of the United States Fisheries Station at San Marcos, Texas, one hundred and eighty-eight feet deep. It is four inches long, totally blind and colorless. It has bushy external gills, and longer legs than any other member of its strange family. Specimens have been kept at the Aquarium over a year.

The European Cave Salamander (*Proteus anguinus*), with the two preceding American species, the Mud Puppy and Blind Salamander, are the only representatives of the family *Proteidae*. Like them, it has bushy external gills and two pairs of limbs, and like the latter is blind and colorless. It inhabits subterranean waters in southern Europe. The largest specimens received at the Aquarium were nine inches long.

The Siren or Mud Eel (*Siren lacertina*) is merely an eel-shaped salamander without the hind legs. Its gills remain in use through life. The mud eel has jaws with horny plates instead of teeth, and inhabits the mud of streams and ponds. It reaches a length of thirty inches, and is found in the southern states as far north as Illinois and Virginia.

SIREN *(Siren lacertina)*

The Congo Eel (*Amphiuma means*) may also be described as an eel-shaped salamander with rudimentary legs. It attains the length of the siren and has similar habits. The female coils around her eggs until they hatch. The legs

AXOLOTL *(Amblystoma tigrinum)*

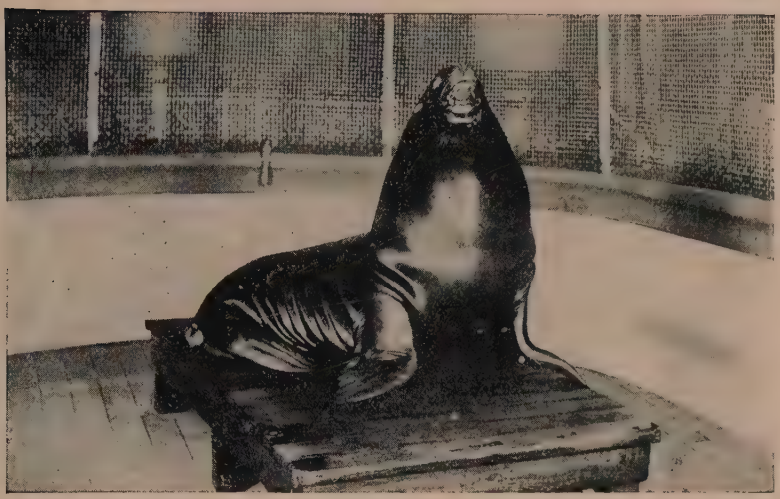
SPOTTED NEWT (*Diemyctylus viridescens*)

of this species, when lost, grow again in about four months. It is also a southeastern species, found from Virginia to Florida and Louisiana.

The Axolotl (*Amblystoma tigrinum*) is a large salamander, usually called Tiger Salamander in its lung-breathing stage. It inhabits the greater part of the central United States. It is common in Mexican lakes where it is taken for food. This species sometimes breeds in the larval or gilled stage. A white or albino form has been bred in captivity, specimens of which have lived in the Aquarium four years.

Our commonest salamander is probably the Spotted Newt (*Diemyctylus viridescens*), also called Red Eft. The young abandon the use of their gills for a season, and live on land, turning bright red. It is found throughout the eastern United States and southern Canada, and is a species that is easy to keep in small aquaria.

About twenty different species of salamanders are to be found within a radius of fifty miles of New York City, most of which are conspicuously colored. Some of them are often received, but are not always placed on exhibition owing to the difficulty of caring for them under present conditions. None of the salamanders is poisonous.



SEA LION *(Zalophus californianus)*

MAMMALS

Seals and Sea Lions—*Pinnipedia*

The California Sea Lion (*Zalophus californianus*) has been exhibited at the Aquarium for many years. It endures indoor life quite well, but being naturally noisy, several individuals have been banished for persistent barking. Sea Lions do not always misbehave, and one now in the Aquarium has been there for eleven years. It weighed in 1917, six hundred and twenty pounds.

This species inhabits the west coast from Washington south to the Gulf of California.

The Fur Seal (*Callorhinus alascanus*), valued for its fur, is the most important of all seals, commercially. More than five millions of skins have been taken at its breeding grounds on the Pribilof Islands in Bering Sea, where the seal herd is under government protection. Formerly very numerous, its numbers were reduced by indiscriminate killing at sea until the species was threatened with extinction. It was finally protected by international agreement, and is now increasing. The Pribilof herd in 1918 numbered 496,-

YOUNG FUR SEAL: MALE *(Callorhinus alascanus)*

000 seals according to a census made in August of that year. Being polygamous, only the surplus males are taken at the Pribilofs. The fur seal is migratory, wintering in the north Pacific Ocean down to the latitude of central California. Specimens have lived eight months in the Aquarium.

WEST INDIAN SEAL *(Monachus tropicalis)*

HARBOR SEALS *(Phoca vitulina)*

The West Indian Seal (*Monachus tropicalis*), now approaching extinction, was formerly abundant throughout the West Indies. It has been brought to the Aquarium several times, one specimen living here over five years. It had the amusing and often exasperating habit of filling its mouth with water and suddenly blowing spray into the faces of visitors. The species still exists in very limited numbers on the Triangle islets in the Gulf of Campeche.

The Harbor Seal (*Phoca vitulina*) does not usually endure indoor life for more than a few months, although one individual lived in the Aquarium eight years. It belongs to the North Atlantic region, sometimes ranging down to the latitude of New York. The specimens received have usually been taken on islands along the coast of Maine, where it breeds in limited numbers.

The Harp Seal (*Phoca groenlandica*) is the basis of a great sealing industry in Newfoundland, where it is taken for oil and leather. This species breeds on the ice floes, and does not thrive in captivity in the latitude of New York. Specimens have lived in the Aquarium only a few months.

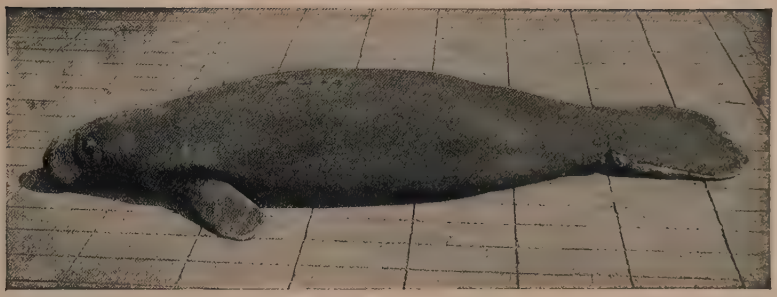
A Pacific coast species, the Elephant Seal (*Mirounga angustirostris*), long believed extinct, was rediscovered by the writer at Guadalupe Island off Lower California in

ELEPHANT SEALS *(Mirounga angustirostris)*

1911. Six two-year-old specimens were brought to the Aquarium, where one of them lived nearly a year. Adult elephant seals killed at the same time and now in the American Museum of Natural History, measured sixteen feet in length. This is the largest of all seals and owes its name to its great size and to the remarkable trunk or snout developed in the adult male. It was formerly abundant in the Lower California region and was killed in great numbers for its oil.

Manatees—*Sirenia*

The Manatee or Sea Cow (*Manatus latirostris*) is sometimes to be seen at the Aquarium. A nine-foot specimen from Florida lived there seventeen months. Although usually found in brackish water, it sometimes ascends freshwater streams to feed on water plants. Manatees never leave the water and are helpless when stranded. They become tame in captivity and can raise the head out of water in taking food held out to them. They sleep at the bottom of the tank, rising to breathe at intervals of five to eight minutes. When the water is drawn out of the pool, a manatee does not take advantage of the opportunity to breathe with greater frequency. The manatee is a warm-blooded, air-



MANATEE *(Manatus latirostris).* From Porto Rico.

breathing, milk-giving water animal. An interesting feature is the position of the milk glands, which are placed close behind the flippers.

The Amazon Manatee (*Manatus inunguis*). This fresh-water "sea cow" came to the Aquarium in 1916. It is smaller than the brackish-water manatees brought from Florida, and, like them, had the habit of turning on its back when the pool was drawn down for cleaning, remaining in that position until the water again became deep enough to float it. Nailless flippers and a white breast are two of the characters which distinguish it from other species. Mana-

Photo by Jos. K. Nye

BOTTLE-NOSED PORPOISES ON THE BEACH AT HATTERAS

HEAD OF THE MANATEE.

Showing the upper lip expanded in reaching for sea-weed. The outer edges fold inward while seizing food.

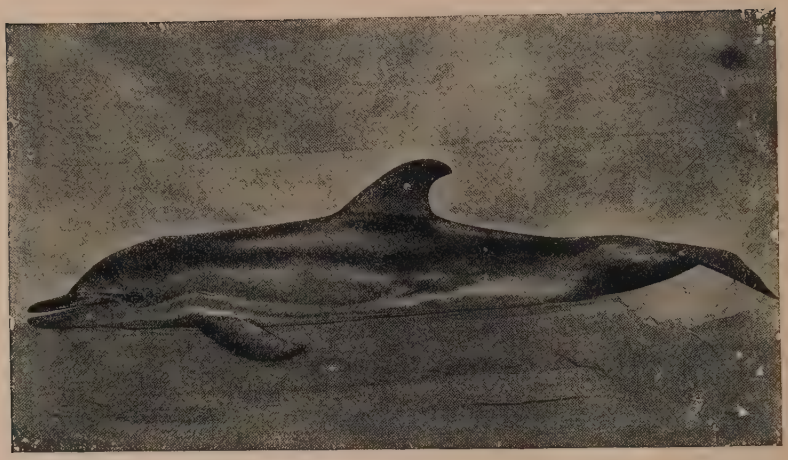
BOTTLE-NOSED PORPOISE *(Tursiops truncatus)*

tees are vegetarians and in captivity are fed chiefly on eel grass (*Zostera*), with some lettuce and trimmings from vegetables. An occasional loaf of bread is also relished. This species inhabits all the upper and middle waters of the Amazon River.

Porpoises, Whales, Etc.—*Cetacea*

The Bottle-nosed Porpoise (*Tursiops truncatus*). Porpoises have been exhibited in the Aquarium at various times. A school of five of these little whales lived many months in the large central pool, and one individual remained there nearly two years. In captivity they leap and disport themselves after the manner of porpoises on the high seas. They are very lively and keep swimming day and night, rising to blow with each circuit of the pool. They often swim under water, belly up, like seals, and sometimes turn both forward and backward somersaults. A more fascinating exhibition of wild life in captivity would hardly be possible. Our porpoises were captured at Hatteras, N. C., where they are taken for their oil and skins. The bottle-nosed porpoise is widely distributed, occurring often in large bands in many parts of the North and South Atlantic.

Other species which have been kept at the Aquarium are Dusky Dolphin (*Lagenorhynchus*), Common Dolphin (*Delphinus*), and White Whale (*Delphinapterus*). The Harbor



DOLPHIN *(Delphinus delphis)*

Porpoise (*Phocaena*) has not yet been received alive, the specimens taken having been injured during transportation.

Beavers—*Rodentia*

The Beaver (*Castor canadensis*), our largest native rodent, was first brought to the Aquarium in 1918. Although naturally a bark eater, it soon learns to like turnips, parsnips and other vegetables. A supply of poplar or birch branches is necessary, however, for an animal of such persistent gnawing habits. The beaver grows quite tame in captivity, readily taking food from the hand. It was formerly very abundant in our northern states, but became scarce years ago as a result of trapping. In the days of its abundance, beaver skins were taken literally by hundreds of thousands. Practically exterminated in New York state, it was reintroduced in the Adirondacks between 1902 and 1904 and is now common in some places. The beaver is celebrated for its industry as a builder of dams and lodges. The former may be many yards in length and the latter seven or eight feet in height. It fells the trees on which it feeds, by gnawing through them, often when they exceed a foot in diameter. In floating building material and food supplies to their lodges beavers construct canals of considerable length.

DOUBLE TAILED HORSESHOE CRAB *(Limulus polyphemus)*

INVERTEBRATES

Crabs, Lobsters, Etc.—*Crustacea*

One of the most interesting invertebrates in the Aquarium, here listed for convenience among crustacea, is the King or Horseshoe Crab (*Limulus polyphemus*), which is found on the Atlantic Coast from Maine to Mexico. It is the nearest living relative of the extinct trilobites, though technically belonging among the spiders. The young look more like the trilobite than does the adult. Along the coasts of New Jersey and Delaware, perhaps its center of abundance, the king crab is of considerable importance as a fertilizer. While edible, it is little used, but serves for bait, and as food for pigs and poultry. It is by far the largest crustacean of our region, sometimes exceeding two feet in length. The king crab may often be seen in shallow water half buried in the mud or sand, through which it persistently plows its way in search of marine worms on which it feeds. It molts its shell frequently, like other crustaceans, and these empty shells are often found drifted along the beach, usually in perfect form for the examination of the naturalist. In Cape May County, New Jersey, immense numbers come ashore in May and June to deposit their eggs. More than a million of them were taken in 1856 along a single mile of shore. It is not as abundant now as formerly.

A large and common crab found all along our coast is the Spider Crab (*Libinia dubia*), which has a spread of legs

SPIDER CRAB *(Libinia emarginata)*

of about eighteen inches. It is a species fond of muddy shores and is common in New York Bay. The spider crab often conceals itself by placing seaweeds and other marine growths on its back, where they stick fast. A similar species and equally large is *Libinia emarginata*. Spider crabs are sluggish creatures and of no food value. The males are much larger than the females.

The Common Shrimp (*Crangon vulgaris*) is brought to the Aquarium in great quantities for the double purpose of serving as an exhibit and especially as food for fishes requiring live food. They constitute, in fact, the principal food of many kinds of fishes. The larger species are edible, and the shrimp fishery of San Francisco Bay yields several millions of pounds a year. Shrimps are very abundant in shallow waters, and there are numerous species.

The Common Prawn (*Palaemonetes vulgaris*) can be distinguished from the shrimp by the sharp-pointed, saw-edged spine which projects forward from between the eyes. It has also longer and more delicate feelers and slenderer legs than the shrimp. Our northern species is small and of

MANTIS SHRIMP *(Squilla emusa)*

little market value but certain southern species are of decided importance as food.

Fishermen sometimes bring in specimens of the Mantis Shrimp (*Squilla empusa*), believing it to be a great rarity, for, being nocturnal, it is not often seen; but the animal is common enough if one knows where to look for it. It is a burrower usually to be found in mud along the low tide level. It is a pale colored creature, sometimes tinted with green or rose color, and is not unknown to clam diggers.

Barnacles, which to the public mind are mollusks, are really crustaceans in spite of their shelly structure. When they open and thrust out their vibrating cirri in search of food, barnacles are among the most interesting invertebrates that can be kept in small marine aquaria. They grow on rocks and wharves almost anywhere, and several species have been kept at the Aquarium. The commonest species on our shores is the Rock Barnacle (*Balanus balanoides*), which is sometimes so abundant as completely to encrust the rocks on which it lives. The long stalked Goose Barnacle (*Lepas anatifera*), which attaches itself to floating drift in the open sea, is probably the most interesting species, and is sometimes brought to the Aquarium.

The largest crab that comes to the Aquarium is the southern Stone Crab (*Menippe mercenaria*), which is found along our South Atlantic and Gulf coasts. It is an edible species and measures five inches or more across the top of its shell.

SEA SOLDIER *(Petrochirus bahamensis)*

There are numerous species of Hermit Crabs, best known of which is *Eupagurus pollicaris.* In hermit crabs the hinder part of the body is not protected, and they live in rejected shells of mollusks for defense, changing to larger shells as they increase in size. In fact, the hermit crab does not always wait for the original occupant to vacate, but forcibly ejects him and takes possession of his home. Hermit crabs, whatever their size, exhibit considerable activity in dragging about their heavy shell homes.

The largest of the hermit crabs to be seen in our tanks comes from Florida, where it is called the Sea Soldier (*Petrochirus bahamensis*). Sea shells of ordinary size are not large enough for it when well grown; and so it houses itself in the big conch shells of tropical waters. It is not always content with the shell it happens to have, and in the Aquarium has been seen to oust another hermit and take forcible possession of its habitation.

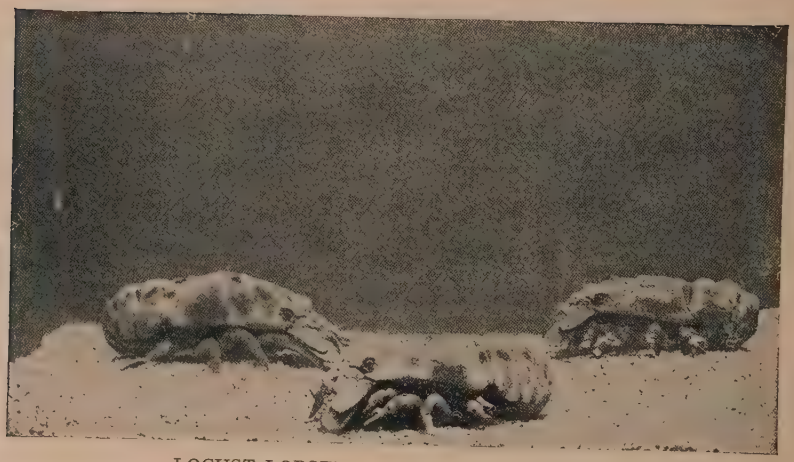
The Soldier Crab (*Cenobita diogenes*) of Florida and the West Indies is largely a land crab, taking to the sea

BLUE CRAB *(Callinectes hastatus)*

only during the breeding season. It ranges far inland, always dragging its heavy habitation, the shell of *Livona pica*. At the Aquarium these hermits are kept in a dry tank.

Next to the lobster the Blue Crab (*Callinectes hastatus*) is the most important crustacean of our waters. Several millions of pounds are caught yearly. It is especially abundant in the Chesapeake region, where it is largely marketed as soft-shell crab. The paddle-like expansions of the last joints of the hindermost pair of legs enable the blue crab to swim rapidly. The blue crab does not hesitate to defend itself, and uses its powerful claws with considerable effect. After moulting the hard shell which it does every summer, it remains in the defenseless soft-shelled condition several days.

Other common species of crabs, but of little edible value, are the Lady Crab (*Platyonichus ocellatus*), Green Crab (*Carcinus maenas*), and Rock Crab (*Cancer irroratus*). The last is sometimes sold as the blue crab when in the soft-shelled stage, after moulting the hard shell, which it



LOCUST LOBSTER *(Scyllarides aequinoctialis)*

does in winter. All of these are common in New York waters.

The Sea Roach or Locust Lobster (*Scyllarides aequinoctialis*) is an interesting crustacean often brought to the

SPINY LOBSTER *(Panulirus argus)*

A GIANT LOBSTER *(Homarus americanus).* From Maine.

Aquarium from Bermuda or Florida. The female is much larger than the male, being sometimes three feet in length. It is a slowly moving creature, more active at night than by day. The sea roach is used for food in the West Indies, and is taken mostly with traps and spears.

The most important crustacean of tropical waters is the Spiny Lobster (*Panulirus argus*). Aquarium specimens are obtained in Florida or Bermuda. It is a very valuable food species, taken in traps and with spears. The spiny lobster has a superficial resemblance to the northern lobster, but lacks the heavy and powerful claws of the latter. A similar species is abundant in southern and Lower California.

The American Lobster (*Homarus americanus*) is our most important crustacean. Over thirty million pounds were marketed in 1889. It is becoming scarce through over-fishing and less than half that quantity is now taken in a greatly increased number of lobster pots. The artificial hatching of lobsters is being conducted on a large scale by the Government Fisheries Bureau. The hatching of the eggs is not difficult, but carrying large numbers of the young through the critical periods of infancy is another matter.

CRAYFISH *(Cambarus affinis)*

In its earlier stages of development the lobster is a free-swimming creature, exposed to a host of natural enemies. On account of its helplessness, its protection is necessary until the fourth molt of the shell has taken place, when it is heavy enough to sink to the bottom and find places for concealment. The proportion of artificially hatched lobsters that can be brought safely to the lobsterling stage, increases from year to year, so that we are encouraged to hope for the ultimate restoration of the lobster fishery by artificial means.

Crayfishes are found in streams and ponds almost everywhere in the eastern states. The principal species in the New York region is *Cambarus bartoni*. This and other species are frequently to be seen in the Aquarium. Crayfishes are closely related to the marine lobster. The largest species is found in Oregon, where great numbers are taken annually. Our small eastern crayfishes are used to a limited extent in the larger cities by the foreign population. To the country lad the "crawfish" is well known as fish bait. While the crayfish can crawl slowly with its numerous legs,

STARFISH *(Asterias forbesii)*

it can move backward with surprising rapidity by a quick movement of the tail. It can defend itself vigorously with the large pincers.

The Fiddler Crab (*Uca pugnax*) lives in immense numbers along muddy banks where its burrows riddle the ground. In the male one claw is very large and is called the "fiddle." These crabs feed chiefly upon marine plants and are much used by anglers as bait. When kept in the Aquarium they are usually provided with a small mound of sand, where their digging habits can be observed.

Starfishes and Sea Urchins—*Echinodermata*

Starfishes do not thrive in captivity and are not always to be seen in the Aquarium. The Common Starfish (*Asterias forbesii*) is found along the Atlantic coast from Maine to the Gulf of Mexico. The starfish feeds on almost any kind of mollusks, and is exceedingly destructive to oysters. Although a stiff and rigid creature, its five arms are capable

of closing tightly around an oyster or clam, while its stomach can be everted to envelope and smother the mollusk until it opens. Time is of little importance to the starfish, and it has only to remain with the oyster long enough to force it open. This species rarely has more than five arms, and it can grow new arms when they are broken off.

The Red Starfish (*Cribrella sanguinolenta*) is a small species about two inches in diameter, found from Long Island Sound northward. In this starfish the newly hatched young cling for a time to the body of the mother.

The largest starfish in our collections is the Giant Starfish (*Pentaceros reticulatus*) which comes from Florida. It is a foot or more in diameter and nearly four inches thick. Its yellowish color makes it quite conspicuous.

Several kinds of small-bodied, long-armed starfishes, usually called Brittle Stars, are found along the adjacent coast, but no serious attempt has been made to care for them in captivity. Their arms drop off unless the animals are handled with the greatest care.

Sea Urchins of two kinds are found along our coast. The Purple Sea Urchin (*Arbacia punctulata*) is sometimes to be seen at the Aquarium, although it does not thrive in captivity. These animals are usually found in shallow water along shore, feeding on sea vegetation. They move by their spines and sucker feet. In some parts of the world sea urchins grow very large and are used for food.

South of Cape Cod the Green Sea Urchin (*Strongylocentrotus drobachiensis*) is found only in deep water, but in the north is enormously abundant in shallow water. Its systematic name is not one that the average person is likely to use glibly.

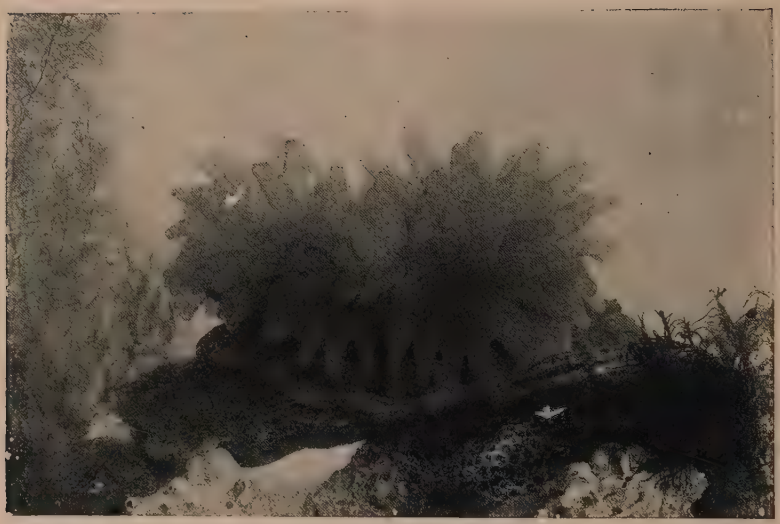
A small and much flattened sea urchin abundant on sandy bottoms from New Jersey northward, is the Sand Dollar (*Echinarachnius parma*).

Jelly-fishes, Anemones and Corals—*Coelenterates.*

A dainty craft floating in tropical waters and sometimes drifting north on the Gulf Stream to our own shores, is the Portuguese Man-of-War (*Physalia arethusa*). This is the

Photo by L. L. Mowbray

PORTUGESE MAN-OF-WAR *(Physalia arethusa)*



CRIMSON ANEMONE *(Tealia crassicornis)*

most conspicuous of the jelly-fishes, as its air-filled float keeps it on the surface. The float is sometimes six inches in length and has along its top a highly colored sail which

ASTRANGIA AND TUBULARIA

Photo by I. P. Gillette

OCTOPUS *(Octopus americanus).*

can be raised at will. The tentacles beneath, trailing down into the water many feet, entangle and paralyze with their stinging cells the smaller fishes with which they come in contact.

Three kinds of Sea Anemones are often brought to the Aquarium—the Brown Anemone (*Metridium marginatum*), the White-armed Anemone (*Sagartia leucolena*), and the Crimson Anemone (*Tealia crassicornis*). The last is found in deep water, and comes from off-shore fishing banks. Sea Anemones are commonly found on rocks and wharf piles along shore. They feed by seizing small particles of food with their outspread tentacles, which are then drawn in toward the central mouth. They can move slowly from place to place by means of a muscular base. A specimen of the white-armed anemone kept in the New York Aquarium was observed to move forty-eight inches on the glass front of the tank in eighty-two days; but only twenty-four days were actually consumed in traveling. Sea anemones have no commercial value, but are eaten by some fishes.

The only species of stony coral existing in our latitude is

Photo by L. B. Spencer

CHANNELLED WHELK SPAWNING, EIGHTH DAY

the Star Coral (*Astrangia danae*), which is found in Long Island Sound. It builds its patches of white coral, two or three inches in diameter, on rocks. Colonies of this polyp have lived in the Aquarium two years at a time. The individual polyps, when expanded, protrude from their coral bases fully an inch.

SHELLFISH—*Mollusca*

Among the large mollusks brought to the Aquarium are the various species of conchs found in Florida and the West Indies, *Strombus gigas, Cassis tuberosa* and *Fasciolaria gigantea*. They do not thrive in captivity owing to the difficulty of providing them with suitable food. The shells of some of these big mollusks are marketed in great quantities for cameo-cutting.

The Sand-collar Snails (*Lunatia heros and Naverita duplicata*) are large, nearly round mollusks, common all along the North Atlantic coast. Their collar-like egg cases are often found in the sand along shore.

Photo by L. L. Mowbray

OCTOPUS IN RESTING POSITION

The Channelled Whelk (*Sycotypus canaliculatus*) also called Winkle, and Conch, is a common object along our shores, and is the largest mollusk brought to the Aquarium from local waters. Another species, the Knobbed Whelk (*Fulgar carica*), of similar size, is equally common. Along with the dead shells of these mollusks as they are thrown on the beaches may often be seen their long strings of egg cocoons, sometimes called "sea necklaces." A channelled whelk in the Aquarium was observed to spawn a string of sixty-three egg cases seventeen inches in length, in eleven days. The shell of the mother whelk was eight inches long. The whelk is sometimes destructive to oysters, but useful as bait. It has a large, muscular foot, which experimentation has shown can be used for soup.

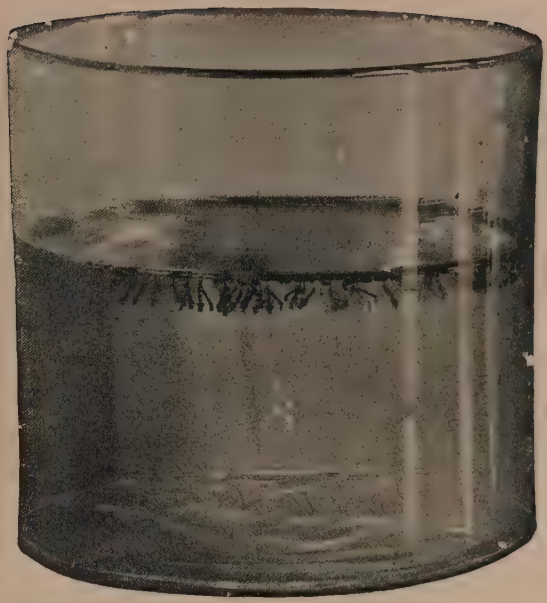
One of the most valuable products of American waters is the Oyster (*Ostrea virginica*) of which many millions of dollars' worth are brought to market yearly. The eastern oyster, found from Maine to Texas, has been transplanted extensively on the Pacific coast. In our bays and sounds

SHIPWORM *(Teredo navalis)*

extensive tracts are devoted to oyster cultivation. As a result of feeding on certain kinds of diatoms, oysters, in some localities, develop green gills, but this does not affect their edible qualities.

Clams and mussels of various species are constantly brought to the Aquarium, where they are used as food for fishes. Both mussels and clams are exhibited at times, but visitors prefer forms which display more activity. Clams and mussels are both valuable as food, but the latter are not used in this country to the extent they merit. The principal food species of the New York region are Soft-shelled Clam (*Mya arenaria*), Round Clam (*Venus mercenaria*), and Edible Mussel (*Mytilus edulis*).

The Octopus or Devil Fish (*Octopus americanus*) is one of the most interesting animals that can be displayed in an aquarium. While it lives well in captivity, it does not stand transportation for long distances and has seldom lived more than a few days when brought to New York from Florida or the Bermudas. The octopus has a parrot-like beak, and feeds on crabs, mollusks and fishes. It can change color rapidly and conceal itself by discharging inky fluids to cloud the water. It is used for food in tropical countries.



MOSQUITO LARVAE

The largest species, found in the north Pacific Ocean, has a spread across the arms of twenty-eight feet.

The enormously destructive Shipworm (*Teredo navalis*) is not really a worm, but is related to the clams, its two small shells enclosing the head-end of the body only. It burrows deeply into submerged wood, slowly but surely weakening and destroying the timbers of wharves and the hulls of vessels, entailing great financial losses to such property, everywhere. It is chiefly on account of the shipworm that wharf piles are expensively treated with creosote and the hulls of vessels provided with copper sheathing for protection. Pieces of wood completely filled with shipworms are sometimes to be seen in the tanks of the Aquarium.

MOSQUITO HATCHING EXHIBIT

During the season of the year when mosquito larvae are obtainable, visitors at the Aquarium take considerable interest in a jar showing the mosquito in its different stages of development. Mosquitoes lay their eggs in clusters on the

BALANCED AQUARIUM

surface of still water, such as is found in rain barrels, cisterns, stagnant ponds and marshes. Each female mosquito lays from 150 to 400 eggs, which, in about a week, hatch into larvae or "wrigglers." About a week later the "wrigglers" become mosquitoes. The mosquito is the only known source of malaria. If the breeding places of mosquitoes can be obliterated, malaria can be wiped out and annoyance from mosquito bites avoided.

CLIMBING PERCH *(Anabas scandens)*

BALANCED AQUARIA

These aquaria are examples of those used by teachers of biology in the New York public schools. The aquaria are provided by the Board of Education. The sea water and specimens they contain are supplied free by the New York Aquarium. Water in such aquaria is seldom changed, being oxygenated by plant life, consisting chiefly of *Ulva* or "sea-lettuce." A member of the Aquarium staff has installed aquaria of this character in three hundred or more schools in New York City, and has instructed teachers as to their management.

FISHES FOR SMALL AQUARIA

There are many species of small fresh-water fishes inhabiting the warmer parts of the old and new worlds, which are bred in captivity by fish fanciers. Most of them are of very small size, averaging less than three inches in length, while a number of them average but half that length at maturity. Exclusive of native species there are more than two hundred such fishes mentioned in the lists of dealers.

HALF MOON *(Pterophyllum scalare)*

They are largely fishes of brilliant coloration or unusual appearance. In the hands of experts they breed freely in captivity and require but little space. Many are of interest, either on account of peculiar nest building habits or because they bring forth their young alive.

Among the species usually obtainable in the larger cities of Europe and America, may be mentioned Paradise fish, Climber, Chanchito, Butterfly, Sword-tail, Gourami, Half-moon, etc. They are not all provided with common names, being as yet known only by their generic names.

The New York Aquarium seldom attempts to keep these small aquaria fishes for the reason that it is not yet provided with suitable quarters for displaying and caring for them.

The few species here described have been received at times and kept in small aquaria in the office or laboratory rooms for limited periods.

Photo by Dr. E. Bade.

BUTTERFLY *(Pantodon buchholzi)*

A fish that can climb is as much of an anomaly as one that can fly. The Climbing Perch (*Anabas scandens*) of the East Indies, has the habit not only of leaving the water and making fair progress on land, but also of ascending the trunks of low trees a few inches. When placed on the floor, as has been done at the Aquarium, it progresses readily, keeping an upright position without falling on its side as fishes usually do.

The Halfmoon (*Pterophyllum scalare*) comes from the upper Amazon, the Essequibo and other fresh waters of northern South America. It is one of the most striking of the tropical fresh-water fishes imported for keeping in small aquaria. It is flattened laterally, the body being rounded and about the size of a silver dollar. The rays of the dorsal, ventral and anal fins are greatly prolonged and the body is cross-banded with black.

The Butterfly (*Pantodon buchholzi*) of tropical West Africa, is remarkable for its enlarged pectoral fins. It was observed by de Brazza to be a fresh-water flying fish. It breeds in small aquaria, the eggs hatching in about a week

The Chanchito (*Heros facetus*) comes from temperate

Photo by Mr. Lee S. Crandall

PARADISE FISH *(Polyacanthus viridiauratus)*

South America. It is also called chameleon, the colors changing at mating time and as it matures. It is hardy and easily bred in captivity, but is pugnacious when kept with smaller fishes.

The brilliantly colored Paradise Fish (*Polyacanthis viridiauratus*) comes from China and has long been domesticated in small aquaria. The male constructs a floating nest of air bubbles, strengthened by a slimy secretion, and watches over the eggs and young.

The Gourami (*Osphromenus olfax*) originated in the East Indies. Under favorable conditions it thrives almost too well for keeping in small aquaria, quite outgrowing its quarters. It makes a large nest of aquatic plants. The first ray of each ventral fin develops into a red filament as long as the fish itself. The gourami is showily marked and has much bronzy sheen.

The Swordtail (*Xiphophorus helleri*) of Mexico and Central America reaches a length of five inches. It is interesting chiefly on account of the dagger-shaped filament composed of the lower rays of the tail, which in the male are greatly elongated.

The Zebra Fish (*Danio rerio*) of southern India and

SALT WATER

ROUND GLASS AQUARIA

FRESH WATER

Ceylon, is seldom more than an inch and a half in length. It is hardy, active and brilliantly colored, with bluish longitudinal bands. The young are not difficult to raise if protected from the parent fishes.

THE CARE OF SMALL AQUATIC ANIMALS

Small Fresh-water Aquaria

An aquarium holding eight or ten gallons of water will be easier to maintain in good condition than one of small size, and will contain a larger number of fishes with a greater degree of safety. An aquarium of rectangular shape is by far the best for permanent use. It should be of strong, clear glass—preferably plate glass—set in a metal framework, and with a slate bottom. Its corners, however, accumulate dirt which is not easily removed.

Aquaria of rectangular form, made wholly of glass, can be purchased and are cheaper, but the glass is never quite clear and they crack more readily from changes in temperature. Cylindrical, glass aquaria are still cheaper, but they distort the forms of the objects they contain to some extent, and are also liable to crack from water pressure. However, aquaria made wholly of glass have the advantage of being absolutely water-tight, while they remain in sound condition, whereas the joints of metal-framed aquaria leak.

Globes are worthless. Good results can not be expected with them. The restricted surface of a globe at the top lessens the amount of water surface exposed to the air. The more surface exposed for the absorption of air, the better.

The aquarium should be placed where the amount of light reaching it can be well controlled. A north window is best, an east window will do, but exposure in other directions will make its care more difficult. If large, the aquarium should be located before it is filled with water.

Sunlight should not often be allowed to fall directly on it, as it stimulates the growth of algæ, and is liable to overheat the water, the temperature of which should be kept steady, not rising above 70° or falling below 40°. A temperature of 50° to 60° is best, and it should not be allowed to vary. Warm water holds less air than cold water, so that a high

temperature is more to be guarded against than a low one.

Water plants are necessary in the aquarium for the aeration of the water, since under proper conditions of light and temperature they give off oxygen which animals require, while the latter exhale carbonic gas. A balance between the animal and plant life of the aquarium is essential for success. Too much plant growth can be checked by reducing the amount of light, which may be shut off by the use of a screen or shade. A greenish film of algæ or confervæ will at times develop rapidly on the glass and obscure the contents of the aquarium. It will have to be rubbed off occasionally, but it is just as well to let it grow on the side next the window where it will serve to restrict the light and also aerate the water. The growth of algæ is lessened by placing the aquarium in a more shaded position. Snails eat algæ rapidly and should be introduced for that purpose, and also because their eggs serve as food for small fishes.

Allow the aquarium to absorb air from its plant life and from the surface of the water for a day or two before putting in the fishes. The latter should be few in number at first. Snails may be added later. Dealers in aquarium supplies usually keep plants, snails, tadpoles, newts and other small creatures as well as fishes.

With running water, plant life can be dispensed with. A collection of large goldfishes in the New York Aquarium has been kept in good condition for many years in flowing Croton water, standing its low temperature in winter very well. The fish are, however, much more active in summer and feed more freely.

The following named water plants are those most frequently used by aquarists: milfoil (*Myriophyllum*), hornwort (*Ceratophyllum*), fanwort (*Cabomba*), water-weed (*Anacharis*), tape-grass (*Vallisneria*), arrow-head (*Sagittaria*), and pondweed (*Potamogeton*). Many other species will serve the purpose. Plants may be anchored by pressing them down into the sand or gravel. Thin strips of lead wound loosely about their roots will hold them securely.

In a well-balanced aquarium the water should not be changed at all. It is, in fact, better without any addition, other than that required to replace what is lost by evaporation. Water should never be added until it has been kept

in the same room with the aquarium long enough to acquire the same temperature.

In siphoning out water from the bottom of the aquarium to clear off sediment or refuse, the water should be saved and strained back. The supply of water may be aerated at times by lifting it with a clean dipper and letting it fall back slowly. A small sprinkling can will also serve for this purpose. All vessels and apparatus used in connection with the aquarium should be perfectly clean, and it is well not to put the hands into the water at all. Assistance in the way of keeping the aquarium clean may be had by introducing a few tadpoles and small newts to act as scavengers, but the latter should be of very small size.

The bottom of the aquarium should be covered to the depth of a couple of inches, with fine gravel, or clean white sand in which fishes may rub themselves; it is also essential for the rooting of plants.

There should not be too much animal life in the aquarium. The fewer and smaller the fishes the less likely is the air in the water to become exhaused. Two or three small goldfishes to each gallon of water is a safe rule to go by, if the aqarium is large. If small the proportion must be reduced. The question the aquarium presents when it has been supplied with water and plants is simply how many fishes or other air consuming creatures can be accommodated in the quantity of water available? Overstocking may disturb the balance within an hour.

It is probably safe to say that a little neglect in the matter of feeding is better for the permanence of the aquarium than over attention. It must not be presumed that because fishes will live for months without feeding, it is right to treat them in that way. Fishes left without food are simply fishes kept hungry and in a condition of slow starvation, which can only be described as cruelty. When there is a large supply of plants in the aquarium the fishes hold out longer, the very small ones especially getting some nourishment from the young shoots of *Anacharis* and other plants.

Many aquarists feed every day, carefully removing all uneaten food, which soon decays and fouls the water. Most prepared foods kept by aquaria dealers are safe, and should

be supplied at least every other day. Finely crushed vermicelli is also good. Some of the ordinary household cereals are available as goldfish food, but the beginner should experiment with them cautiously. Other foods are, however, desirable at times. Once a week, pieces of very small earth worms, or bits of fresh beef should be furnished. If they can be given to each fish on the tip of a broom straw the chances of contaminating the water by waste food will be lessened. All uneaten food must be picked, dipped, or siphoned out, or foul water and a disturbance of the delicate balance of the aquarium will be the result. A milky appearance of the water is usually a warning against careless feeding. Nearly all diseases which appear among goldfishes indicate that the aquarium needs looking after. The unsightly growths of fungus on fishes, caused by the plant parasites, *Saprolegnia* and *Devoea,* indicate careless handling of the fishes, or bad conditions prevailing in the aquarium. When the conditions are right, diseases are not likely to appear. Too high a temperature favors the growth of fish fungus.

This disease is hard to deal with and infected fishes should be removed at once and kept by themselves, where, under proper conditions, they may possibly recover. A pinch of salt put in the water with them may arrest the disease, but when in bad condition a teaspoonful of salt to each gallon of water will be necessary. If other fishes are obtainable, it is just as well to kill diseased specimens, since the fungus roots penetrate well into the flesh and can not be destroyed if the growth is far advanced. Animal parasites on fishes should be picked off after the fish has been carefully lifted in the dip net.

One of the first indications of trouble in the aquarium is the presence of the fishes at the surface with their mouths out of the water, showing that they are suffering for lack of air. The water may be dipped up and allowed to fall back slowly, but the relief afforded will be merely temporary. The temperature of the aquarium should be observed and some of the fishes removed. It may be necessary to increase the quantity of plant-life or stimulate its growth by admitting more light. If the weather is not cold and the window

can be opened, air blowing across the surface of the water will be helpful since it may only be necessary to aerate the water and lower the temperature somewhat. There may be refuse at the bottom which should, of course, be removed.

In taking care of the aquarium, a few simple implements, such as a half-inch rubber tube for siphoning out the water, a glass "dip tube" for removing small particles of dirt from the bottom, a shallow dip net of cheesecloth for lifting fishes, and a cloth-covered pad or rubber scraper with a long handle for cleaning the glass, will be necessary. The dip tube is operated by closing the top opening with the finger to admit or exclude the water as desired. A pair of long wooden forceps and a slim stick are also useful for removing plants and other objects without putting the hands into the water.

One other aid in the management of the aquarium should not be overlooked. A reliable book on aquaria and their care is essential, and the amateur will need to refer to it frequently. The New York Aquarium can supply *The Care of Home Aquaria*, 63 pages, illustrated; price fifty cents, by mail fifty-five cents.

Turtles and Small Alligators

These animals do not thrive in the hands of the amateur, especially in winter, if one may judge by the number of emaciated specimens annually presented to the Aquarium.

The returning Florida tourist usually has some baby alligators, which refusing to feed in our chilly northern climate, are brought to the Aquarium, perhaps during intensely cold weather, in nothing warmer than a pasteboard box. If this last thoughtless act does not finish them at once the attendants may be able to revive them. Cold-blooded reptiles, such as turtles and alligators, must have warm quarters. They should be kept in aquaria or other vessels into which sunlight can enter, and the vessel placed where it will not become cold. If kept near a window for the benefit of the sunshine, which is life to them, care should be taken that they are also near a heater.

The temperature of the ordinary living-room in winter is scarcely high enough to keep alligators active, since they

need a warmth of 80° to 90°. They require not only warm water, but a place where they can crawl out at times. The water need not be more than a few inches deep, and the platform or small log on which they rest should be placed in such a way that they can climb upon it easily. Alligators in captivity are most comfortable and active when they have access to water that is nearly tepid, and it is their habit to float much on the surface. Turtles require not only warm water, but also the heat of the sun. For that reason turtles do not flourish as well in the New York Aquarium as they would in a building more accessible to sunshine. The temporary warming of torpid alligators or turtles in boxes set near a heater is useless. If they can not be kept where both air and water are permanently warm, they should be dispensed with.

The numerous chilled and weak alligators sent to the Zoological Park each year, are placed in the sunny Reptile House in a tank of water with a steam pipe in it. After a thorough warming up in water of 80° to 90° temperature, they begin to feed, and in three years will be a yard long, and weigh twelve or fourteen pounds. The state of Florida is making a mistake in allowing the present heavy export of young alligators, which are practically all lost by being carried north. Large alligators are now scarce, and the supply of alligators for leather is decreasing.

Since alligators and turtles do not feed unless kept permanently warm, it is necessary to provide them first with quarters where they will have a temperature of certainly not less than 75° of both air and water. They should also have the benefit of sunshine. Forcing cold alligators to eat by cramming food into their mouths is admissible only temporarily. They will eat freely when the water and air are warm enough, and will grow amazingly. They eat such a variety of foods that it is easy enough to provide for them.

Alligators and snapping turtles are flesh eaters and may be provided with small minnows, frogs, tadpoles, worms, grubs, crayfish, shrimps and small crabs, either dead or alive. When these can not be had, they will eat fresh chopped meat, fish, clams and oysters. Many kinds of turtles will eat all of the above named foods, as well as snails, small aquatic

mollusks, and insects. Others like very tender, green vegetables, such as tomatoes, lettuce, celery, and various water plants. The food of some species consists largely of the bulbs of sedges, (*Cyperus*), while with others it is chiefly small water mollusks.

Some of the turtles are active fish eaters, and will do well if supplied with live minnows. The wood-turtles and other species which forage on land as well as in the water, are fond of berries, mushrooms, and many kinds of fruits and vegetables, while nearly all kinds will eat grubs. The tortoises eat berries, mushrooms, and some garden vegetables as well as grubs and worms.

Turtles should be provided with a variety of foods until the kinds suited to each species are ascertained. Many species of turtles feed only under water, consequently it is absolutely necessary for them to have access to it when fed.

If their surroundings can be made to approach natural conditions—that is, if they can have access to a compartment in their quarters where there are dry sand, earth and sods, where grubs, worms and other food can be thrown in abundance, success in keeping them will be more likely to follow. It is remarkable how quickly they learn the exact location of food and drink. Once fed in a certain location, they will seek that place when urged by hunger.

Small Salt-water Aquaria

A salt water aquarium in the home is a comparatively easy feat for residents of the coast, who may collect plants and animals for themselves and procure plenty of sea water; but for the inland aquarist it is a matter requiring more delicate care and closer concentration.

Salt water can be shipped inland from the coast with the animals and plants. Formulas for the preparation of artificial sea water have been devised, but we do not know of anyone who has succeeded with them.

Salts in water are not subject to great evaporation. It is it therefore quite practicable to replace loss through evaporation in the salt water aquarium with fresh water from the faucet once a week, and a watering can is very good for the purpose.

It is 75 years since the first salt water balanced aquarium was established in England, and many experimenters have been at work in the field since that time; but for the securing of a perfect balance of marine animals and plants it is still difficult to suggest an infallible rule. As with fresh-water forms, the animals depend largely upon the oxygen thrown off by the plants, while the plants take up the carbonic acid gas exhaled by the animals; and, as with fresh water, the aquaria whose capacity is measured by the gallon are more satisfactory than those holding only quarts. There is small danger from an excess of plants, but too much animal life is certain to prove fatal.

All-glass aquaria are the best for salt water.

Marine collections of the "happy family" order are successfully maintained at the Aquarium in eight-gallon jars, with two kinds of plants and as many as eleven forms of animal life. The plants are the red alga *Soleria chordalis*, sometimes attaching itself to rocks and again living free at the bottom, and the green sea-lettuce (*Ulva latissima*), buoyed with bits of cork to cover two-thirds of the surface and allowed to hang down ten inches from the top on the side of the jar nearest the light. The animals are:

Northern white coral (colonies ranging in size from 2 to 6 inches in diameter);
Brown anemones (3 or 4);
White anemones (3 or 4);
Tunicates (*Molgula*) (3 or 4);
Killifishes, 2 inches long (2 or 3);
Variegated Minnows, 2 inches long (2 or 3);
Prawns, 1¼ inches long (2 or 3);
Young eels, 3 or 4 inches long (1 or 2);
Mud Snails (*Nassa obsoleta*) (1 to 12);
Oyster (1);
Little-neck clam (*Venus mercenaria*) (1).

Warning has been given the beginner by some aquarists to limit his animals one to the gallon of water. It can be seen from the list just given that a gallon will accommodate more than one animal—even more than four—but in experiments with marine aquaria too much moderation cannot be urged at the start.

Sea-lettuce is absolutely essential for the balanced aquarium. Other plants may be used with it, as the red alga, called "Flame Weed" (*Grinella americana*); and dead, sun-dried hydroids such as *Sertularia argentea* and S. *pinnata*, make good ornamental effects.

Other animals that can be successfully confined in balanced aquaria are small mussels—say a quarter of an inch in length, rock barnacles, annelids (especially the tube dwellers), and very small crabs. Large crabs tear the plants and catch the fishes, but small specimens of the mud and spider crabs one-half inch or so in diameter, are interesting (crabs being truly comical animals) and desirable for they pick up scraps from the bottom; and the small hermit crabs are especially good scavengers.

It is well to place an inch or two of fine pebbles, white sand, or bird gravel on the bottom of the jar, and a few stones must be added for the attachment of anemones and for the crabs to hide under. Care must be taken to wash the sand thoroughly. Bird gravel is very dirty and will ruin the aquarium if put in before cleansing.

Hermit crabs should be provided with empty shells of a suitable size so that when they outgrow the home they are living in and go house-hunting for a larger one, the new tenement will be at hand.

Little-neck clams and oysters whose siphons are always busy, are valuable as clarifiers.

Snails that consume vegetation should be avoided. The periwinkles do not thrive as well in standing water, but no balanced aquarium is complete without a few mud snails (*Nassa obsoleta*). These do not harm the vegetation appreciably, preferring animal food, and besides being excellent scavengers, are always interesting to watch, with their long inquisitive siphons travelling on before like an elephant's trunk.

Young specimens of starfishes may be kept. They live on mollusks, however, and a supply of the mud snails is necessary for them. With a starfish it would not be possible to keep an oyster, clam, or any other mollusk alive in the jar, and at best the starfishes are not long-lived in captivity.

Probably the most attractive of all small fishes is the sea-horse. The little creature is difficult to provide for except with running sea water, rarely having been maintained longer than a few months in balanced aquaria. It will eat nothing but living, moving animals of minute size, such as fresh and salt water crustaceans—*Gammarus, Daphnia,* etc.; worms—tube worms, Tubifex, *enchytrae,* etc.; and the young of small, live-bearing, tropical fishes, such as Guppyi, Helleri, Gambusia, etc.

Other fishes, also crabs and prawns, annoy the sea horses, but it is possible to keep anemones, barnacles, oysters and clams in the same jar with them.

The salt water aquarium requires strong light, but should have very little direct sunlight,—none in the summer and not over an hour or two a day in winter. The most useful cover is one made of plain glass of the same diameter as the jar, with bits of cork glued to its edges at several places in such wise as to allow it, when set on the jar, to rest on the corks a quarter of an inch above the top of the aquarium. Such a cover prevents the escape of crabs, snails, etc., retards evaporation, and keeps out dust.

Animals in all balanced aquaria at the New York Aquarium are fed three times a week with macerated clam. Care is taken to drop small pieces from the end of a stick or long wooden forceps upon the tentacles of the corals and anemones. All food not eaten within a few hours is carefully siphoned off with a glass tube.

For the inland aquarium, dried shrimp, dessicated cod fish after the salt has been soaked out of it, fresh-water mussels, or fresh fish, finely chopped, would serve. Fresh fish, however, is oily, and even an expert aquarist must take unusual care in using it.

A bit of wood fastened to the end of a stick and covered with felt or cheesecloth, is useful to clean the inside of the glass. The speedy removal of dying plants and dead animals is very essential. For this, a long wooden forceps is a convenient tool. Some aquarists advocate a bit of charcoal placed under the rocks as a clarifier. During a succession of gray days, the water may be aerated by lifting out a dipper full at a time and letting it fall back from a height

of several inches. When the sand appears dirty, it is well to siphon off the bottom with a rubber tube until about four inches of the water have been drawn. This can be used again by filtering through four or five thicknesses of cheesecloth, or letting it seep through a sponge placed in the bottom hole of a watering can. The same method may be employed if the water appears a trifle cloudy.

IDA M. MELLEN.

SALAMANDERS AND FROGS

Salamanders and frogs are included among the animals classified as Amphibians,—those leading a "double" life. They are born in the water and pass through a gilled, tadpole stage, later undergoing metamorphosis and developing lungs for air breathing. The majority live both on land and in the water, but some forms adopt a land life, returning to the water only during the breeding season, to deposit their eggs.

Salamanders are frequently confused with lizards, because of a resemblance in the shape of their bodies. The salamander is a smooth skinned air and water breathing animal—an amphibian, while the lizard is a scaly reptile, born on land, living in dry places, and never supplied with gills.

The care and feeding of salamanders and frogs is one of the regular inquiries made at the Aquarium. They should be provided with aquaria or tanks so arranged that they may pass in and out of the water at will. This can be accomplished by placing rocks, sand, gravel or moss in one end of the receptacle.

Large salamanders, such as the hellbender (*Cryptobranchus allegheniensis*), mud puppy (*Necturus maculatus*), and giant salamander (*Cryptobranchus maximus*), require running water, which for these species need not be warmed in winter. In fact, all thrive better in running water, though the smaller varieties have been kept successfully in still water changed daily in winter and oftener in summer. Those that are fed live food, can catch their prey better in shallow water. The temperature of the water for frogs, and for all the smaller salamanders except the Shasta salamander (*Chondrotus tenebrosus*) should be maintained at from 68°

to 75° Fahr. For the Shasta salamander, accustomed to cold mountain streams, the water should not be allowed to rise above 72° Fahr.

The blotched (also called marbled, and opaque) salamander is fond of sandy soil.

A limited number of frogs in the tadpole stage, say two tadpoles to each gallon of water, may be kept in balanced aquaria.

Most salamanders, and all frogs, are cannibals, at least in captivity. To prevent loss of stock, care should therefore be taken to place together only those of approximately the same size.

Frogs in the tadpole stage eat water weeds and grasses, and may also be fed minced meat, liver and fish. Adult frogs devour almost any live moving object which it is possible for them to swallow, that comes within range of their eversible tongues,—grasshoppers, snails, spiders, crickets, worms, beetles, crustacea (especially sow-bugs), and other frogs. The bull frog (*Rana catesbiana*), in addition to all these items, seeks larger fry, and besides preying extensively on its own kind, is said to find palatable small fishes, snakes, shrimps and crayfishes, also young turtles, field mice, young ducks, and other small water birds.

Various species of the frog have been kept at the Aquarium, including the bull frog (*Rana catesbiana*), salt marsh frog (*Rana virescens*), pickerel frog (*Rana palustrus*), green frog (*Rana clamitans*), and leopard frog (*Rana pipiens*). They have lived from six months to two years on the following diet: Earthworms, meal warms, grasshoppers, crickets, spiders, thousand legged "worms," leaf hoppers, and beef and liver cut in small strips to give the appearance of earthworms. When they do not pick up flesh so prepared, they can often be induced to take it when dangled before them on a slim feeding stick.

The natural food of all varieties of the salamander consists, for the most part, of worms, insects, spiders, crustacea (shrimps, crayfishes, sow-bugs, etc.), and mollusks (snails, slugs, mussels, etc.). Large salamanders add small frogs to their menu. In captivity nearly all salamanders eat meal worms, earth worms and minced fish.

Meal worms are kept by dealers in aquaria supplies and serve very well in winter when other live foods are difficult to secure. Earthworms are usually obtainable as long as the ground remains unfrozen.

The larger salamanders, hellbenders, mud-puppy and giant, feed on crayfishes and other small crustacea, insects and their larvae, earthworms, snails, spiders, beetles, small frogs and fishes. In captivity they will take also meal worms, minnows, and any kind of chopped fish.

The smaller salamanders necessarily take smaller natural foods. While they feed on much that is eaten by the large salamanders, they take also the larvae of many insects.

Some of the numerous species of small, native salamanders kept at the Aquarium, can be induced to eat worm-like strips of fresh beef and fish when tempted to do so by having such foods dangled before them, and all accept meal worms.

It is said that wire worms will attack and kill the common green newt—a danger to be guarded against if earth is placed in the aquarium in which the newt is kept. This species, at irregular intervals, adapts itself to a terrestrial existence. On first leaving the water it becomes of a brownish hue, and after being for some time on land, assumes a brilliant, orange-red. In this state it lives in damp woods, under stones and fallen leaves, and if taken captive can be maintained in a terrarium well supplied with damp moss, where it will eat small insects, meal worms, earthworms, etc. On returning to an aquatic life, it again acquires the characteristic green color. While living on land it is known as the red eft.

The common newt has lived in the Aquarium for three years. It accepts food during all seasons, taking chopped clam and fish as well as enchytrae and meal worms, though the California newt is said to eat very little sometimes, for months at a time. The blotched, tiger, spotted, red, red-bellied, slimy, Shasta, and blind salamanders have survived for from one to three years, and the Congo Eel for five years; while of the three largest salamanders, the mud puppy or water dog has lived in the Aquarium for four years, the hellbender and giant five years.

Ida M. Mellen.

Index

Abramis crysoleucas 25
Abudefduf saxatilis 76
Acantharcus pomotis 36
Acipenser brevirostris 44
Acipenser rubicundus 16
Acipenser sturio 44
Alectis ciliaris 55
Aleutera schoepfii 89
Alewife 48
Alligator 113
Alligator Snapping Turtle 103
Alligators—Care of Small 156
Alosa sapidissima 47
Amazon Manatee 125
Amazon Turtle 110
Amberfish 56
Ambloplites rupestris 36
Amblystoma tigrinum 120
Amia calva 19
Ameiurus natalis 21
Ameiurus nebulosus 20
Ammodytes americanus 53
Amphiuma means 119
Anabas scandens 149
Anchovy 48
Anemones 141
Angelfishes 84
Angler 99
Anguilla chrysypa 26
Anisotremus surinamensis 69
Anisotremus virginicus 72
Aphredoderus sayanus 34
Aplodinotus grunniens 40
Arbacia punctulata 138
Archosargus probatocephalus 74
Aquaria—Balanced
  Care of Fresh-water 152
  Care of Salt Water 158
  Fishes for Small 147
  School Aquaria 147
Aquarium—New York
  Collections 12
  Equipment 9
  Publications 173
Aromochelys odoratus 109
Asterias forbesii 137
Astrangia danae 142
Astroscopus guttatus 94
Atlantic Green Turtle 110
Atlantic Salmon 27
Axolotl 120
Balanced Aquaria—See Aquaria.
Balanus balanoides 131
Balistes carolinensis 87
Balistes vetula 87
Barnacles 131
Barndoor Skate 43
Barracuda 52
Barrel-fish 57
Bass Killy 40
Bass: Calico 37
  Channel 75
  Large-mouthed Black 36
  Sea 60
  Small-mouthed Black 37
  Striped 61
  White 39
Bathystoma striatum 69
Beau Gregory 78
Beaver 128
Bellows-fish 99
Bermuda Chub 74
Big-Eye 65
Black Angelfish 84
Black Margate 69
Black Pilot 57
Black Rockfish 59
Black-spotted Trout 29
Blackfish 80
Blanding's Turtle 103
Blind Fish 33
Blind Salamanders 117–118
Blue Angelfish 84
Blue Crab 133
Blue Parrotfish 81
Blue-striped Grunt 69
Blue Tang 86
Bluefish 56
Bluehead 81
Blunt-nosed Shiner 56
Bodianus fulvus 59
Boleosoma nigra olmstedi 39
Bonito 54
Bottle-nosed Porpoise 127
Bowfin 19
Box Tortoise 106
Boxfish 91
Brevoortia tyrannus 47
Brittle Stars 138
Brook Lamprey 16
Brook Trout 30
Brown Trout 28
Buffalo-fish 22
Buffalo Trunkfish 89
Bull Frog 115
Bullhead 20
Burbot 41
Butterfish 58
Butterfly Fish 86–149
Butterfly Ray 44
Calamus arctifrons 72
Calamus bajonado 72
Calamus calamus 72
Calamus proridens 72
Calico Bass 37
California Sea Lion 121
Callinectes hastatus 133
Callorhinus alascanus 121
Cambarus bartoni 136
Campostoma anomalum 25
Cancer irroratus 133
Canthidermis maculatus 87
Caranx chrysos 56
Caranx hippos 56
Carassius auratus 24
Carcharias littoralis 42
Carcharias milberti 42
Carcinus maenas 133
Carpiodes velifer 23
Carps 23
Cassis tuberosa 142
Castor canadensis 128
Catfish: Common (Bullhead) 20
  Mississippi 21
  Sea 45
  Spotted (Channel, Blue) 19
  Yellow 21

Catostomus commersonii 22
Cenobita diogenes 132
Centropomus undecimalis 58
Centropristes striatus 60
Cephalacanthus volitans 96
Chaenobryttus gulosus 35
Chaetodipterus faber 84
Chaetodon capistratus 86
Chaetodon ocellatus 86
Chanchito 149
Channel Bass 75
Channelled Whelk 143
Channomuraena vittata 47
Chelonia mydas 110
Chelonia virgata 112
Chelopus guttatus 107
Chelopus insculptus 105
Chelops muhlenbergii 100
Chelydra serpentina 102
Chelys fimbriata 109
Chilomycterus schoepfii 91
Chrysemys elegans 102
Chrysemys picta 107
Chrysemys rubriventris 102
Chrysemys scabra 102
Chub—Bermuda 74
Chub Mackerel 54
Chub Sucker 22
Cinosternum pennsylvanicum 102
Clams 144
Climbing Perch 149
Clupea harengus 48
Codfish: Fresh-water 41
Marine 97
Codling—Spotted 98
Conch 142
Coney 59
Conger Eel 45
Congo Eel 119
Corals 141
Coregonus clupeiformis 30
Cow-nosed Ray 44
Cowfish 89
Crabeater 57
Crabs 129
Crangon vulgaris 130
Crappie 38
Crayfishes 136
Crevalle 56
Cribrella sanguinolenta 138
Cristivomer namaycush 28
Croaker 75
Crocodile—American 113
Cryptobranchus alleghaniensis 117
Cryptobranchus maximus 116
Cubbyu 77
Cumberland Turtle 102
Cunner 80
Cusk—Fresh-water 41
Cyclopterus lumpus 93
Cynoscion regalis 76
Cyprinodon variegatus 49
Cyprinus carpio 23

Danio rerio 150
Darter—Tessellated 39
Dasyatis centrura 44
Delphinapteras 127
Delphinus 127
Devil Fish 144
Diamond-back Terrapin 106
Diemyctylus viridescens 120
Diodon hystrix 92
Doctor Fish 87
Dog Snapper 67
Dogfish 19
Dolphins 127
Drumfish: Fresh-water 40
Salt Water 76

Echeneis naucrates 96
Echinarachnius parma 138
Eel 26
Eel Pout 95
Elephant Seal 123
Elops saurus 47
Emys blandingi 103
Epinephelus adscensionis 59
Epinephelus guttatus 59
Epinephelus morio 64
Epinephelus striatus 62
Eques lanceolatus 77
Eretmochelys imbricata 110
Erimyzon sucetta 22
Eucalia inconstans 33
Eupagurus pollicaris 132
Eupomacentrus leucostictus 78
Eupomotis gibbosus 35
European Cave Salamander 118
European Rudd 26

Fasciolaria gigantea 142
Fiddler Crab 137
Filefishes 87
Fishing Frog 99
Flounders 98–99
Fluke 98
Flying Gurnard 96
Four-Eyes 86
French Angelfish 84
Fresh-water Cusk 41
Fresh-water Drum 40
Frogs 114
Frogs—Care of 162
Fulgar carica 143
Fundulus diaphanus 32
Fundulus heteroclitis 49
Fundulus majalis 49
Fur Seal 121

Gadus callarias 97
Gag 59
Gars: Alligator 19
Bony 17
Short-nosed 17
Silver 49
Gasterosteus bispinosus 50
Giant Salamander 116
Ginglymostoma cirratum 42
Glut Herring 47
Goggle-Eye 36
Goggler 56
Golden Ide 24
Golden Shiner 25
Golden Tail 78
Golden Trout 27
Goldfish 24
Goldfishes—Care of 152
Goose Barnacle 131
Goosefish 99
Gourami 150
Grass Porgy 72
Gray Snapper 67
Grayfish 42–43
Grayling 30
Graysby 61
Green Crab 133
Green Frog 115
Green Parrotfish 81
Green Sea Urchin 138
Green Turtles 110–112
Groupers 58
Grunts 69

Gurnard 95
Haddock 98
Haemulon flavolineatum 69
Haemulon sciurus 69
Hakes 98
Half Beak 49
Half Moon 149
Harbor Porpoise 127
Harbor Seal 123
Harp Seal 123
Harpe rufa 79
Harvestfish 58
Hawksbill Turtle 110
Hellbender 117
Hemitripterus americanus 93
Herrings 47–48
Heros facetus 149
Hickory Shad 47
Hermit Crabs 132
Hexanematichthys felis 45
Hinds 59
Hippocampus hudsonius 51
Hogfishes 78
Holocentrus ascensionis 53
Homarus americanus 135
Horned Chub 24
Horned Pout 20
Horney Chub 22
Horse-Head 55
Horseshoe Crab 129
Humpback Salmon 27
Hyporhampus roberti 49

Ictalurus furcatus 21
Ictalurus punctatus 19
Ictiobus cyprinella 22
Idus idus 24
Iridio bivittatus 81
Iridio radiatus 80

Jack 31–38
Jellyfishes 138
Jewfish 59
Jolt-head Porgy 72

Killifishes: Fresh-water 32
Salt Water 49
King Crab 129
King Herring 48
Kingfish 76
Knobbed Whelk 143
Kyphosus sectatrix 74

Lachnolaimus maximus 78
Lactophrys tricornis 89
Lactophrys trigonus 89
Lactophrys triqueter 89
Lady Crab 133
Ladyfish 79
Lafayette 75
Lagocephalus laevigatus 90
Lagodon rhomboides 72
Lampetra wilderi 16
Lamprey: Brook 16
Sea 41
Landlocked Salmon 27
Leather Jacket 56–87
Leatherback Turtle 112
Legenorhynchus 127
Leiostomus xanthurus 75
Leopard Frog 115
Lepas anatifera 131
Lepisosteus osseus 17
Lepisosteus platostomus 17
Lepisosteus tristoechus 19
Lepomis auritus 34
Lepomis megalotis 34
Lepomis pallidus 34
Leptocephalus conger 45
Libinia dubia 129
Libinia emarginata 130
Limulus polyphemus 129
Ling 41
Little-head Porgy 72
Lobotes surinamensis 65
Lobsters 134–135
Log-fish 57
Loggerhead Turtle 112
Look-Down 55
Lophius piscatorius 99
Lophopsetta maculata 99
Lota maculosa 41
Lucius americanus 32
Lucius lucius 31
Lucius masquinongy 32
Lucius reticulatus 31
Lump Sucker 93
Lunatia heros 142
Lycodontis funebris 45
Lycodontis moringa 4

Mackerel 54
Macrochelys lacertina 103
Malacanthus plumieri 93
Malaclemmys centrata concentrical 106
Malacoclemmys geographica 103
Manatees 124–125
Mantis Shrimp 131
Map Turtle 103
Margate—Black 69
Matamata Turtle 109
Melanogrammus aeglefinus 98
Menhaden 47
Menidia notata 52
Menippe mercenaria 131
Menticirrhus saxatilis 76
Mesogonistius chaetodon 35
Metridium marginatum 141
Microgadus tomcod 98
Micropogon undulatus 75
Microspathodon chrysurus 78
Micropterus dolomieu 37
Micropterus salmoides 36
Minnows—See Killifishes.
Mirounga angustirostris 123
Mola mola 92
Mollusks 142
Monacanthus hispidus 89
Monachus tropicalis 123
Moonfish 54
Morays 45
Morone americana 62
Mosquitoes 145
Moxostoma aureolum 22
Mud Eel 118
Mud Puppy 117
Mud Turtle 102
Mudfish 19
Mugil cephalus 52
Muhlenberg's Turtle 109
Mullet 52
Mummichog 49
Musk Turtle 109
Muskallunge 32
Mussels 144
Mustelus canis 42
Muttonfish 67–95
Mya arenaria 144
Myctroperca bonaci 59
Mycteroperca microlepis 59
Mycteroperca olfax 59

Mycteroperca phenax 59
Mycteroperca tigris 64
Mycteroperca venenosa 59
Myoxocephalus octodecimspinosus 93
Mytilus edulis 144

Nassau Grouper 62
Naucrates ductor 55
Naverita duplicata 142
Necturus maculosus 117
Neomaenis analis 67
Neomaenis apodus 67
Neomaenis aya 66
Neomaenis griseus 67
Neomaenis jocu 67
Neomaenis synagris 67
Newt—Spotted 120
Nurse Shark 42

Ocean Sunfish 92
Ocean Turbot 87
Octopus 144
Ocyurus chrysurus 65
Oligoplites saurus 56
Oncorhynchus gorbuscha 27
Oncorhynchus tschawytscha 27
Opisthonema oglinum 47
Opsanus tau 95
Orange Filefish 89
Orthopristis chrysopterus 70
Osmerus mordax 49
Osphromenus alfax 150
Oswego 37
Oyster 143

Pacific Green Turtle 112
Paddle-Fish 16
Painted Turtle 107
Palaemonetes vulgaris 130
Palinurichthys perciformis 57
Pampanos 55–56
Pantodon buchholzi 149
Panulirus argus 135
Paradise Fish 150
Paralichthys dentatus 99
Paralichthys oblongus 99
Parrotfishes 81
Pearl Roach 26
Pentaceros reticulatus 138
Perca flavescens 39
Perch: Pike 38
  Pirate 34
  White 62
  Yellow 39
Petrochirus bahamensis 132
Petrometopon cruentatus 61
Petromyzon marinus 41
Phoca groenlandica 123
Phoca vitulina 123
Phocaena 128
Phycis regius 98
Physalia arethusa 138
Pickerels 31–32
Pickerel Frog 116
Pigfish 70
Pike 31
Pike—Sand 38
Pike—Wall-eyed 38
Pike Perch 38
Pilot-fish 55
Pinfish 72
Pipefish 50
Pirate Perch 34
Platyonichus ocellatus 133
Podocnemis expansa 110
Pogonias cromis 76
Pollack 98
Polyacanthis viridiauratus 150
Polyodon spathula 16
Pomacanthus arcuatus 84
Pomacanthus paru 84
Pomatomus saltatrix 56
Pomolobus aestivalis 47
Pomolobus mediocris 47
Pomolobus pseudoharengus 48
Pomoxis annularis 38
Pomoxis sparoides 37
Porcupine-fish 92
Porgies 72
Porkfish 72
Porpoises 127
Portugese Man-of-War 138
Prawn 130
Princess Rockfish 59
Prionotus carolinus 96
Prionotus strigatus 95
Promicrops itaiara 59
Proteus anguinus 118
Pseudopleuronectes americanus 99
Pseudopriacanthus altus 65
Pseudoscarus guacamaia 81
Pterophryne histrio 102
Pterophyllum scalare 149
Pteroplata maclura 44
Pudding-wife 80
Puffers 89–90

Queen Angelfish 84
Queen Triggerfish 87
Quillback 23
Quinnat Salmon 27

Rabirubia 65
Rachycentron canadus 57
Raia erinacea 43
Raia laevis 43
Raia ocellata 43
Rainbow Parrotfish 81
Rainbow Trout 29
Rana catesbiana 115
Rana clamata 115
Rana palustris 116
Rana pipiens 115
Rana sylvatica 116
Rays 44
Red-bellied Turtle 102
Red Drum 75
Red Eft 120
Red-Eye 36
Red Grouper 64
Red Hind 59
Red Horse Sucker 22
Red Parrotfish 81
Red Snapper 66
Redfish 65
Remora 96
Rhinoptera bonasus 44
Rhombus triacanthus 58
Rhypticus bistrispinus 64
Ribbonfish 77
Roaches 25
Robalo 58
Roccus chrysops 39
Roccus lineatus 61
Rock Bass 36
Rock Crab 133
Rock Hind 59
Rockfish 61
Rockfish—Black 59
Rockfish—Princess 59

Rockfish—Tiger 64
Round Pampano..... 56
Rudd 26
Rudderfish 56–57–74
Runner 56

Sagartia leucolena..... 141
Sailor's Choice..... 72
Salamanders 116
Salamanders—Care of..... 162
Salmo fario..... 28
Salmo irideus..... 29
Salmo pleuriticus..... 29
Salmo salar..... 27
Salmo sebago..... 27
Salmons 27
Salvelinus aurcolus..... 27
Salvelinus fontinalis..... 30
Sand Dollar..... 138
Sand Collar Snails..... 142
Sand Lance..... 53
Sand Pike..... 38
Sandfish 93
Sarda sarda..... 54
Sargasso Fish..... 102
Saucer-Eye Porgy..... 72
Sauger 38
Scamp 59
Scardinius erythropthalmus..... 26
Scarus caeruleus..... 81
Schoolmaster 67
Sciaenops ocellatus..... 75
Scomber colias..... 54
Scomber scombrus..... 54
Screaming Frog..... 115
Sculpin—Long-spined 92
Scup 74
Scyllarides aequinoctialis..... 134
Sea Anemones..... 141
Sea Bass..... 60
Sea Catfish..... 45
Sea Cow..... 124
Sea Horse..... 51
Sea Lion..... 121
Sea Raven..... 93
Sea Roach..... 134
Sea Robin..... 95
Sea Soldier..... 132
Sea Trout..... 76
Sea Urchins..... 138
Seals 121
Selene vomer..... 54
Semotilus atromaculatus..... 24
Sergeant Major..... 77
Seriola lalandi..... 56
Seriola zonata..... 56
Shad 47
Shad—Hickory 47
Sharks 42
Shark Sucker..... 96
Sheepshead 74
Sheepshead Minnow..... 49
Shellfish 142
Shiner—Blunt-nosed 56
Shiner—Golden 25
Shipworm 145
Shrimp 130
Silver Gar..... 49
Silversides 52
Silvery Moonfish..... 54
Siphostoma fuscum..... 50
Siren 118
Skates 43
Sliders 102
Slippery Dick..... 81
Smelt 49
Snake—Water 114
Snappers 65–67
Snapping Turtles..... 102
Snook 58
Soapfish 64
Soft-shelled Turtles..... 105
Soldier Crab..... 132
Spadefish 84
Spanish Hogfish..... 79
Sparisoma abildgaardi..... 81
Sparisoma viride..... 81
Spheroides maculatus..... 90
Spheroides spengleri..... 91
Sphargis coriacea..... 112
Sphryna zygaena..... 42
Sphyraena barracuda..... 52
Spider Crabs..... 129
Spiny Boxfish..... 91
Spiny Lobster..... 135
Spot 75
Spot Snapper..... 67
Spotted Codling..... 98
Spotted Turtle..... 107
Squalus acanthias..... 43
Squeteague 76
Squilla empusa..... 131
Squirrel Fish..... 53
Squirrel Hake..... 98
Starfishes 137–138
Stargazer 94
Stenotomus chrysops..... 74
Stickleback: Brook..... 33
Two-spined 50

Sting Ray..... 44
Stizostedion canadense..... 38
Stizostedion vitreum..... 38
Stolephorus mitchilli..... 48
Stone Crab..... 131
Stone Roller..... 25
Striped Bass..... 61
Strombus gigas..... 142
Strongylocentrotus drobachiensis 138
Sturgeon: Common..... 44
Lake 16
Short-nosed 44

Suckers 22
Sunapee Trout..... 27
Sunfish—Ocean 92
Sunfishes—Fresh-water 34–35–36
Surgeon—Blue 86
Swordtail 150
Sycotypus canaliculatus..... 143

Tarpon 47
Tautog 80
Tautogolabrus adspersus..... 80
Tealia crassicornis..... 141
Ten Pounder..... 47
Tench 26
Teredo navalis..... 145
Terrapene carolina..... 106
Tessellated Darter..... 39
Tetronarce occidentalis..... 44
Teuthis caeruleus..... 86
Teuthis hepatus..... 87
Texas Blind Salamander..... 117
Thalassochelys caretta..... 112
Thalassoma bifasciatus..... 81
Thread Fish..... 55
Thread Herring..... 47
Thymallus tricolor..... 30
Tiger Rockfish..... 64
Tinca 26
Toadfish 95
Tom Tate..... 69

Tomcod 98
Torpedo 44
Tortoise-shell Turtle..... 110
Trachinotus carolinus..... 55
Trachinotus falcatus..... 56
Trachiurops crumenopthalmus... 56
Trigger-fishes 87
Trionyx ferox..... 105
Trionyx spinifer..... 105
Triple-tail 65
Tropidonotus fasciatus..... 114
Trouts 28
Trunk Turtle..... 112
Trunkfishes 89
Turbot—Ocean 87
Tursiops truncatus..... 127
Turtles 102
Turtles—Care of..... 156
Tylosurus marinus..... 49
Typhlomolge rathbuni..... 117
Typhlichthys subterraneus..... 33

Uca pugnax..... 137
Urophycis chuss..... 98
Urophycis tenuis..... 98

Venus mercenaria..... 144
Vomer setipinnis..... 56

Wall-Eyed Pike..... 38
Warmouth 35
Water Dogs..... 117
Water Snake..... 114
Weakfish 76
West Indian Seal..... 122
Whales 127
Whelks 143
White Bass..... 39
White Hake..... 98
Whitebait—See Anchovy, Spearing, Herring, Smelt, Silversides.
White Perch 62
Whitefish 30
Whiting 76
Winkle 142
Wood Frog..... 116
Wood Turtle..... 105

Xiphophorus helleri..... 150

Yellow-bellied Slider..... 102
Yellow-fin Grouper 59
Yellow Grunt..... 69
Yellow Perch..... 39
Yellow-tail Angelfish..... 84
Yellowtail 65

Zalophus californianus..... 121
Zebra Fish..... 150
Zoarces anguillaris..... 95

Errata

17, 18, 19 For *Lepisosteus*, read *Lepidosteus.*
25 For *crysolencas*, read *crysoleucas.*
30 For *clupeiformis*, read *clupeaformis.*
36 For *Acantharcus*, read *Acantharchus.*
37 For Crappie (*Pomoxis annularis*), read Calico Bass (*Pomoxis sparoides*).
40 Preceding "The Fresh-water Drum," read Drumfishes or Croakers—Sciaenidae.
54 For *Selsne*, read *Selene.*
115 For *catesbiana*, read *catesbeiana.* For *clamata*, read *clamitans.*
116 For *allzghaniensis*, read *alleganiensis.*
117 For *alleghaniensis*, read *alleganiensis.*
118 For *anguinus*, read *anguineus.*
131 For *emusa*, read *empusa.*
162 For *allegheniensis*, read *alleganiensis.*
163 For *catesbiana*, read *catesbeiana.*

The New York Zoological Society

General Information

The Zoological Park:—The New York Zoological Society is a scientific organization incorporated under the laws of New York State, and in addition to the direction of the Aquarium, controls and manages the Zoological Park in the Bronx, which it founded, and opened to the public in 1899, by agreement with the City of New York.

Unlike most of the Zoological Gardens of Europe, the Park is free every day in the year, except Monday and Thursday of each week—when a fee is charged. It is open from 10:00 A. M. until a half-hour before sunset, and all holidays are free days.

The grounds, many of the buildings and the annual maintenance fund are provided by the City of New York; the remainder of the buildings and entire animal collections are the gift of the Society.

Statistics:—In area, the Park is 264 acres—a magnificent domain to be thus dedicated to zoology and public instruction. There are 35 acres of water, and the land—comprising heavy and open forests and meadows, is about the same proportion. The extreme length of the Park is 330 less than a mile, and the width about three-fifths of a mile.

Exhibits:—The more important buildings in the Park are the houses for the Elephants, Lions, Tigers and Leopards, Great Apes and Monkeys, Wild Horses and Zebras, Rare Birds of Tropical and Temperate Zones, Reptiles, Antelopes, Kangaroos, Ostriches, Small Mammals and the Aquatic Birds. The open air enclosures are the Bear Dens, Flying Cage, Pheasant Aviary, Eagle and Vulture Aviary, Wolf and Fox Dens, Burrowing Rodents' Quarters, Beaver Pond, Duck Aviary, Wild Fowl Pond, Crane Paddock and Mountain Sheep Hill.

The most valuable and important collections are the lions, tigers and leopards, tropical hoofed animals, wild equines, bears, American bison and apes and monkeys. The most interesting animals are the chimpanzees and orang-utans, and the baboons and monkeys in the Primate House— and the pygmy hippopotami at the Elephant House. The collections of bears and antelopes are the equals of the largest and rarest of their kinds to be found elsewhere, the reptiles cannot be excelled and the collections of living birds is the largest and most complete in the world.

Membership:—The creation of a great zoological garden or park requires besides an exhibit, the support of a great many people, and much money. The annual expenditures for animals—all of which is supplied by the Zoological Society—are very considerable and a large membership is vitally necessary to the existence of this organization.

Membership in the Zoological Society is open to all who are interested in the objects of the organization and desire to contribute toward its support.

Classes:—Annual Membership is $10. This entitles the holder to admission to the Zoological Park on pay days, when the collections may be seen to the best advantage, all publications of the Society, privileges of the Administration Building lectures, special exhibitions, and ten complimentary tickets to the Zoological Park for distribution.

Dues:—Annual Members may become Life Members by the payment of $200; a subscriber of $1,000 becomes a Patron; $2,500, an Associate Founder; $5,000, a Founder; $10,000, a Founder in Perpetuity, and $25,000, a Benefactor.

Application for membership may be given to the General Secretary, 101 Park Avenue; the Clerk, New York Aquarium, Battery Park, or the Chief Clerk, Zoological Park, New York City.

Transportation:—The quickest and most direct way to get to the Zoological Park is by Subway and the station nearest to the Park is 180th *Street* Zoological Park. Take the 7th Avenue Subway Express marked, 180th Street, Bronx Park—at South Ferry and ride to the end of the line. If the Lexington Avenue Express is used —from Bowling Green Station—it will be necessary to change trains at the 177th Street Station.

The Zoological Park entrance is one and one-half blocks beyond the 180th Street, Zoological Park Station.

	Paper	Cloth
A Monograph of the Pheasants (*Beebe*) Four Royal Quarto Volumes		$250.00
Illustrated in colors from paintings by Thorburn, Lodge, Knight, Fuertes and Jones, and many photogravures and maps. Sold in sets only. Completed.		
Galapagos: World's End (*Beebe*)		9.00
444 pp., 24 color plates and 83 other illustrations in black and white.		
Tropical Wild Life (*Beebe; Hartley; Howes*)		3.00
Postage-weight, 3 pounds		
Heads and Horns Brochure, Nos. 1–2 (*Hornaday*), each	1.00	
Postage, 5 cents copy		
Our Vanishing Wild Life (*Hornaday*)	*[Out of Print]*	

ANNUAL REPORT

No. 1—(1896) 64 pp. 7 ills. maps & plans	.40	
Rept. on Bronx Park (*Hornaday*)		
Rept. on European Tour (*Hornaday*)		
Needs of Artists in the Zoological Park (*Thompson*)		
No. 2—(1897) 144 pp. 16 ills., 3 maps & plans	.75	1.00
London Zoological Society & Gardens (*Hornaday*)		
School of Animal Painting & Sculpture (*Thompson*).		
Destruction. Birds and Mammals (*Hornaday*)		
No. 3—(1898) 80 pp. 9 ills.	.40	.60
Mammals, Stickine, Dease & Liard Rivers (*A. J. Stone*)		
No. 4—(1899) 104 pp. 14 ills.	.40	.60
Openings of the Zoological Park		
No. 5—(1900) 140 pp. 21 ills. 2 maps	.75	1.00
Collecting Reptiles in North Carolina (*Ditmars*)		
Notes on Mt. Sheep of No. Am. (*Hornaday*)		
No. 6—(1901) 176 pp. 20 ills.	.75	1.00
The Giant Tortoise (*Ditmars*)		
Success of Indoor Flying Cage (*Beebe*)		
Society's Expedition to Alaska (*Grant*)		
Destruction of Animal Life. Alaska (*Loring*)		
No. 7—(1902) 208 pp. 39 ills. 1 map	1.00	1.25
Public Aquariums of Europe (*Townsend*)		
Modes of Tubercular Infection (*Blair*)		
Cysticerci in Wild Ruminants (*Blair*)		
Developments and Feeding of Reptiles (*Ditmars*)		
Psychology of Birds (*Beebe*)		
Home of the Giant Tortoise (*Beck*)		
The Caribou (*Grant*)		
No. 8—(1903) 216 pp. 56 ills	1.00	1.25
New Species of Raccoon Dog (*Hornaday*)		
Notes on the Manatee (*Townsend*)		
Infecting Oysters with Typhoid Bacilli (*Field*)		
Cage Paralysis (*Brooks*)		
Internal Parasites (*Blair*)		
Observations on Lacertilians (*Ditmars*)		
Among the Birds on Cobb Island (*Beebe*)		
Origin and Relationship of the Large Mammals of North America (*Grant*).		
No. 9—(1904) 272 pp. 75 ills	1.25	1.50
Landscape and Forestry, Zoological Park (*Grant*)		
List of Trees, Zoological Park (*Merkel*)		
A New White Bear (*Hornaday*)		
Notes on Pinnipeds (*Townsend*)		
List of Fishes, N. Y. Aquarium (*Townsend*)		
Osteomalacia, Primates (*Brooks-Blair*)		
Observations on Poisonous Serpent (*Ditmars*)		
New Species of Rattlesnake (*Ditmars*)		
Variation of *Crotalus lucifer* (*Ditmars*)		
Ostriches and Their Allies (*Beebe*)		
Rocky Mountain Goat (*Grant*)		
No. 10—(1905) 244 pp. 67 ills. 1 map	1.25	1.50
Ungulates in the Zoological Park (*Hornaday*)		
Fungus on the American Chestnut (*Merkel*)		
Radiographs (*Townsend*)		
Our Collection of Amphibians (*Ditmars*)		
The Swans (*Beebe*)		
Wichita Buffalo Range (*Loring*)		
Idaho Moose (*Brooks*)		
Mt. Goat Hunting with the Camera (*Osborn*)		
No. 11—(1906) 224 pp. 46 ills	1.00	1.25
Cultivation of Fishes (*Townsend*)		
A Peculiar Skin Disease (*Blair*)		
Actinomycosis in Black Mt. Sheep (*Blair*)		
Growth of the Alligator (*Ditmars*)		
Owls of the Nearctic Region (*Beebe*)		
List of Birds in the Park (*Beebe*)		
No. 12—(1907) 144 pp. 15 ills	1.00	1.25
Pollution of Streams (*Townsend*)		
Condition of Wild Life in Alaska (*Grant*)		
No. 13—(1908) 184 pp. 23 ills. 2 plans	1.00	1.25
Color changes among tropical Fishes (*Townsend*)		
No. 14—(1909) 170 pp. 23 ills. 2 plans	1.00	1.25
Twelve years' perspective of the Zoological Park (*Hornaday*)		

	Paper	Cloth
No. 17—(1912) 160 pp. 12 ills.	1.00	1.25
Distribution and Habits of the Pygmy Hippo (*Schomburgk*)		
Vertebrates, N. Y. Aquarium (*Osborn*)		
No. 21—(1916) 174 pp. 25 ills.	1.00	1.25
Tropical Research Station (*Beebe*)		
No. 22—(1917) 162 pp. 20 ills.	1.00	1.25
Migratory Bird Treaty Resolution		
No. 24—(1919) 204 pp. 24 ills.	1.00	1.25
Books; Aquarium Library (*Mellen*)		
No. 27—(1922) 220 pp. 23 ills.	1.25	1.50
Twenty-eight Years of Zoological Society Accomplishment (*Osborn*)		
Zoological Society's Gifts to the People (*Hornaday*)		
Nos. 15, 16, 18, 19, 20, 23, 25, 26, 28—	1.00	1.25
Documents and Reports only		
Postage, Reports, 10 cents		

ANNUAL REPORT REPRINTS

Destruction of Our Birds and Mammals (*Hornaday*)	.15	
Notes on Mountain Sheep of North America (*Hornaday*)	.40	
The Caribou (*Grant*)	.40	.60
Modes of Tubercular Infection (*Blair*)	.25	
Home of the Giant Tortoise (*Beck*)	.25	
New Species, Raccoon Dog (*Hornaday*)	.25	
Cage Paralysis (*Brooks*)	.15	
A New White Bear (*Hornaday*)	.15	
Certain Pinnipeds (*Townsend*)	.25	
Ostriches and Their Allies (*Beebe*)	.25	
Our Amphibians (*Ditmars*)	.15	
The Swans (*Beebe*)	.25	
Actinomycosis, Black Mt. Sheep (*Blair*)	.15	
Cultivation of Fishes (*Townsend*)	.25	
Growth of the Alligator (*Ditmars*)	.15	
Owls of Nearctic Region (*Beebe*)	.25	
Condition, Wild Life, Alaska (*Grant*)	.15	
List Birds Zoological Park (1909) (*Beebe*)	.15	
Goat Hunting with Camera (*Osborn*)	.15	
Postage, Reprints, 5 cents		

ZOOPATHOLOGICA VOL. I

Parasite Trematodes (*Mac Callum*)	.25
New Parasitic Worms (*Mac Callum*)	.25
Telorchis and other Trematodes (*MacCallum*)	.25
The Polystomidae (*MacCallum*)	.25
Camallanus and other Nematodes (*MacCallum*)	.25
Studies in Helminthology (*MacCallum*)	.50
Postage, Zoopathologica, 5 cents	

ZOOLOGICA VOL. 1

	Paper	Cloth
1—Geographic Variation in Birds (*Beebe*)	.30	
2-3—Ecology of the Hoatzin: Birds of Venezuela (*Beebe*)	.50	
4—New species of Insects (*Beebe*)	.25	
5-6—Racket Formation, Tail Feathers; Supernumerary Toe, Hawks (*Beebe*)	.25	
7—Juv. Plumage Yucatan Jay (*Beebe*)	.15	
8—Northern Elephant Seal (*Townsend*)	.25	
9—Affections of Respiratory and Digestive Organs, Primates (*Blair*)	.15	
10—New Blood Pheasant (*Beebe*)	.15	
11—Feeding Habits, Serpents (*Ditmars*)	.50	
12-13-14—Ontogeny, the White Ibis; Specialization, Taildown in Ducks; Postponed Moult, Certain Passerines (*Beebe*)	.25	
15—Pheasant Studies (*Beebe*)	.25	
16—Porpoise in Captivity (*Townsend*)	.25	
17-18—The Genus Gennaeus (*Beebe*)	.25	
Notes on Costa Rican Birds (*Crandall*)	.25	
19—Natural History, Whale Shark (*Gudger*)	.30	
20—Ectoparasitic Trematodes (*MacCallum*)	.25	
Postage, Zoologica, 5 cents		
Parts 1–20. . . . . *Not Bound*	3.85	
Parts 1–20. . . . . *Bound*		6.00
Postage-weight, 4 pounds		

ZOOLOGICA VOL. II

1—Two Series of Amphibians (*Deckert*)	.25
2—Tetrapteryx Stage, Ancestry Birds (*Beebe*)	.25
3-4—Notes, Birds, Para, Brazil: Fauna of Jungle Debris (*Beebe*)	.25
5—The Gaff-Topsail Catfish (*Gudger*)	.25
6—Mammals of Australia in the Zoological Park (*W. H. D. Le Souef*)	.75
7, 8, 9—Vertebrates, Bri. Guiana (*Beebe*)	.25
10—Habits of Sage Grouse (*Horsfall*)	.25
11—Eclipse Plumage, Domestic Fowl (*Crandall*)	.25
12—Life History, Puffer (*Welsh-Breder*)	.25
13—Hermaphroditism of the Croaker (*Breder*)	.25
14—Food of Certain Minnows (*Breder-Crawford*)	.25
15—Fishes of Sandy Hook Bay (*Breder*)	.25
16—Weaving of Weaver Birds (*Friedman*)	.25
17—Scales of Whitefishes (*Mellen-Van Oosten*)	.30
18—Anderson Tree Frog (*Noble*)	.25
Postage, Zoologica, 5 cents	

ZOOLOGICA VOL. III

1–2—Objects, Trop. Res. Sta. (*Osborn*)	.25
Contributions, Trop. Res. Sta. (*Beebe*)	.25

	Paper	Cloth
3-11—Social Beetles, British Guiana (*Wheeler*)	1.00	
Tachigalia Ants (*Wheeler*)		
Habits of Cucujidae (*Wheeler*)		
New Coleoptera (*Schwarz-Barber*)		
Larvae, Pupae, Social Beetles (*Boving*)		
New Diadiplosis (*Felt*)		
New Blepyrus (*Brues*)		
Tachigalia Membracids (*Herbert Osborn*)		
New Entomobrya (*Folsom*)		
12—Fetuses, Guiana Howling Monkey (*Schultz*)		
13—Mammals Collected Trop. Res. Sta. (*Anthony*)	.25	
14-15—New Batrachians (*Noble*)	.25	
New Lizards (*Noble*)		
16—Descriptiones Termitum in Anglorum Guiana Reportorum (*Silvestri*)		
17—New Genera and Species, Termitrophilous Coleoptera (*Mann*)		
18—Glandular Structure, Abdominal Appendages, Termite Guest (*McIndoo*)		
19—Termitophilous Apterygota (*Folsom*)		
20—Three Apparently New Species, Termitaphis (*Morrison*)		
21—Termitophilous Millipeds (*Chamberlin*)	.75	
22-23—A Termitophilous Braconid; Two Myrmecophilous Phoridae (*Brues*)	.25	
Postage, Zoologica, 5 cents		

ZOOLOGICA VOL. IV

1—Fishes, Amphibians, Reptiles (*Breder*)	.15
2—Frozen Mammoths (*Lang*)	.25
Postage, Zoologica, 5 cents	

ZOOLOGICA VOL. V

1—Williams Galapagos Expedition (*Beebe*)	.15
2—Galapagos Heterocera (*Schaus*)	.20
3—Galapagos Lepidoptera (*Beebe*)	.15
4-16—Ichthyology (*Nichols*)	
Apterygota (*Folsom*)	
Homoptera (*Osborn*)	
Mallophaga (*Ewing*)	
Diptera (*Johnson*)	
Arachnida (*Banks*)	
Formicidae (*Wheeler*)	
Triungulin Larvae (*Brues*)	
Chilopods (*Chamberlin*)	
Coccidae (*Morrison*)	
Brachyuran Crabs (*Rathbun*)	
Macrura and Anomura (*Schmitt*)	
Hymenoptera (*Rohwer*)	.50
17—Neuroptera (*Banks*)	.15
18—Isopods (*Van Name*)	.25
19—Parasitic Copepods (*Wilson*)	.15
20—Coleoptera (*Mutchler*)	.20
21—Hemiptera-Heteroptera (*Barber*)	.15
Postage, Zoologica, 5 cents	

ZOOLOGICA VOL. VI

1—Ecology of Kartabo (*Beebe*)	1.00

	Paper	Cloth
2—Birds of Kartabo (*Beebe*)	.25	
3—Membracidae, Kartabo (*Haviland*)	.35	
4—Termites of Kartabo (*Emerson*)	.**	
(*In preparation*)		

ZOOLOGICAL SOCIETY BULLETIN

Bulletin—*Bi-monthly*..25c each; Yearly $1.50

Bulletin, Nos. 1, 6, 8, 35, 43, 44, 48, 50 March, 1915, November, 1916 and 1918 [*Out of Print*]

Single copy, by mail, 30 cents

MISCELLANEOUS

Official Guide Zoological Park (*Hornaday*) ..... (postage 6c.) .50

Pets, and How to Care for Them (*Crandall*) 303 pages, 59 illustrations. Cloth (postage 12c.) 2.00

Post Cards: 63 Subjects in colors, in sets of 21, set..... (postage 2c.) .25

Souvenir Book: 24 pages, 75 four-color illustrations..... (postage 3c.) .75.

Animals in Art Stamps: 32 page album; 120 mounting spaces; 120 four-color animal stamps—complete (postage 6c.) .85

Wild Animal Stamp Primer: 96 pages; 49 animal stories, 50 mounting spaces and 50 four-color animal stamps—complete..... (postage 7c.) 1.00

Panorama: Zoological Park, colored—flat or folded..... (postage 2c.) .15

Photo-Letter: 18 pictures, four colors—two letters..... .10

Photogravures: Animals and views in the Zoological Park: 12 Subjects. Sepia—two prints... (postage 2c.) .25

Enlargements: Animal subjects—11 × 14 inches

Black and white, *each* (postage 2c.) .25

Duotone, brown, *each* (postage 2c.) .35

Photographs: Mammals, birds, reptiles, etc.,..... each 50 cents

Photographs for publication, lantern slides, transparencies and enlargements, subject to correspondence.

Publications.—All available Society publications may be obtained by addressing H. R. Mitchell, Chief Clerk, Zoological Park, 185th St. and Southern Boulevard, New York City, N. Y.

New York Aquarium Nature Series

Sea Shore Life (*Mayor*), cloth..*Net* 1.20

Cultivation of Fishes in Ponds (*Townsend*), paper..... .25

Chameleons of the Sea (*Townsend*) paper..... .25

Northern Elephant Seal (*Townsend*), paper..... .25

Porpoise in Captivity (*Townsend*), paper..... .25

Natural History of the Whale Shark (*Gudger*)..... .25

The Gaff-Topsail Catfish (*Gudger*), paper..... .25

Illustrated Guide to the Aquarium (*Townsend*), boards..... .50

Fishes in the Home (*Ida M. Mellen*), paper..... .50

Aquarium Post Cards: Colored. In sets..... .25

All mail orders except "Sea Shore Life", add 5c. postage.

The New York Aquarium Nature Series may be obtained by writing The Clerk, New York Aquarium, Battery Park, N. Y.

P8-CUV-809